
Missouri Registry Annual Report

**Registry of Confirmed Abandoned or Uncontrolled
Hazardous Waste Disposal Sites in Missouri**

Fiscal Year 2018



**Missouri Department of Natural Resources
Division of Environmental Quality
Hazardous Waste Program**

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*Fiscal Year 2018
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P.O. Box 176
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573-751-8629
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Missouri Department of Natural Resources

Missouri Registry Annual Report

INTRODUCTION

As required by Section 260.445, RSMo, the Missouri Department of Natural Resources prepares an annual report regarding sites listed on the Registry of Confirmed Abandoned or Uncontrolled Hazardous Waste Disposal Sites in Missouri. The Department provides a copy of the Registry Report to the General Assembly, Governor, Missouri Hazardous Waste Management Commission, and the governing body of each county containing a Registry site. The report also is available on the Department's website.

The Missouri Hazardous Waste Management Law regarding the Registry (Sections 260.435 to 260.480, RSMo) can be viewed at <http://moga.mo.gov/mostatutes/stathtml/26000003501.html>.

REGISTRY AND REGISTRY PROCEDURES

REGISTRY OF CONFIRMED ABANDONED OR UNCONTROLLED HAZARDOUS WASTE DISPOSAL SITES IN MISSOURI (REGISTRY)

The Registry is a list of sites in Missouri that contain abandoned or uncontrolled hazardous waste. More than that the Registry provides a variety of institutional controls allowing residual contamination to be left on site after cleanup is completed while still protecting human health and the environment. These institutional controls include: deed notification of contamination; annual inspection; notice to buyer; change of use review; notice to the state if property is sold; cleanup and removal from the Registry; and public information about site location, classification of threat, contaminants, health concerns, public and private drinking-water wells, and geology.

In addition, the information in the Registry notifies the public about property on the Registry and its associated hazards. This report informs potential buyers about hazards and legal obligations they may undertake if they purchase such property.

The Registry is not intended or legally required to provide a comprehensive inventory of sites where hazardous chemicals and wastes have been disposed in Missouri. Instead, it is developed based on a specific legal mandate, which directs that sites be listed on the Registry if they are contaminated with hazardous substances that:

- A. Meet the legal definition of hazardous waste according to Missouri statutes and regulations. In practice, this means definitions the state has incorporated by reference from federal statute, the Resource Conservation and Recovery Act of 1976 (RCRA), and would be subject to RCRA regulations. A waste is considered hazardous under RCRA if it meets either of the following criteria:
 - a. It is specifically listed or identified as a hazardous waste in the Code of Federal Regulations due to its composition and source, or
 - b. It exhibits one or more characteristics of a hazardous waste, which are ignitability, corrosivity, reactability, or toxicity as determined by laboratory analysis;

- B. Were disposed of before state and federal regulations were established for that kind of waste, which began in 1980, or disposed of illegally since that time; and
- C. Are present at concentrations above health-based screening levels.

Each site on the Registry is described in detail in this annual report (starting on page 16) and includes the following information:

- A. A general description of the site, including the name and address, owner, and the type and quantity of hazardous waste disposed there.
- B. A summary of any significant environmental problems at and near the site, and the site's proximity to private residences, public buildings or property, school facilities, places of work, or other areas where individuals may be present regularly.
- C. A summary of any serious health problems in the immediate vicinity of the site and any health problems deemed by the Department to be related to conditions at the site.
- D. The status of any testing, monitoring, or remedial actions in progress or recommended by the Department; the status of any pending legal actions and any federal, state, or local government permits; and the relative priority for remedial action at each site.

A site assessment committee evaluates the sites on the Registry and assesses classification changes. The committee is composed of representatives from the Department's Hazardous Waste Program, Water Protection Program, Environmental Services Program, and Missouri Geological Survey; and a representative from the Missouri Department of Health and Senior Services. The committee can take into account new information about a site or remedial measures taken to reduce potential risk. If conditions at a site have changed over the past fiscal year, the committee may recommend a change in classification that better defines the threat to human health and the environment posed by a site.

Registry sites are placed in one of the following categories:

- Class 1: Sites presenting an imminent danger of causing irreversible or irreparable damage to public health or environment—immediate action required.
- Class 2: Sites posing a significant threat to the environment—action required.
- Class 3: Sites not presenting a significant threat to public health or the environment—action may be deferred.
- Class 4: Sites that have been properly closed—require continued management.
- Class 5: Sites that have been properly closed with no evidence of present or potential adverse impact—no further action required. Class 5 sites are removed from the Registry.

The relative need for action at each site is based solely upon the potential impact on public health and the environment. The type of action required, the feasibility of such an action, and its cost or benefits are not the primary factors in deciding whether action is needed.

REGISTRY PROCEDURES

The Department investigates potential abandoned or uncontrolled hazardous waste disposal sites and identifies those that should be placed on the Registry. When hazardous waste is confirmed at a site, the Department notifies the owner or owners that it intends to place the property on the Registry. The notification is sent by certified mail to the owner's last known address 30 days before the site is to be listed on the Registry.

The owner or operator may appeal the proposed addition to the Registry to the Administrative Hearing Commission, which conducts hearings in accordance with Section 621.250, RSMo. No site may be listed on the Registry until an appeal is resolved. Once the notice of appeal is filed, the Administrative Hearing Commission has 90 days to hold a hearing and 120 days to issue a recommended decision on the appeal to the Hazardous Waste Management Commission. The Hazardous Waste Management Commission reviews the Administrative Hearing Commission's

recommended decision and issues a final decision.

To avoid Registry listing, a responsible party or site owner may remediate the site. Generally, the Department will enter into an agreement with the party that ensures cleanup progresses in a timely manner and recognizes the Department's oversight role. With those controls in place, the Department will then suspend further actions to list the property on the Registry.

If the owner does not want the entire property placed on the Registry, the listing may be limited to the contaminated portion of the property if the owner or operator submits a land survey performed by a licensed surveyor that includes the contaminated area plus a buffer zone in all directions. This allows the owner or operator unrestricted use of the portion of the property that is not contaminated.

When a site is placed on the Registry, the Department files a notice of the listing in the property chain of title with the Recorder of Deeds. If a site is properly closed, with no evidence of a potentially adverse impact, this finding also is filed with the Recorder of Deeds. These actions notify any purchasers of the property that the site is or has been on the Registry.

Once a site is placed on the Registry, it is subject to certain restrictions. The use of the site shall not change substantially without the written approval of the director of the Department. A change of use is considered substantial if it may result in: the spread of contamination, an increase in human exposure to hazardous materials, an increase in adverse environmental impacts, or a situation making potential remedial actions at the site more difficult. The seller must notify the buyer of the condition of the site prior to sale. Changes of ownership must be reported to the Department within 30 days after the change.

Additional information on the Registry and Registry procedures is available on the Department's website <https://dnr.mo.gov/env/hwp/sfund/registry.htm>.

NPL SITES IN MISSOURI

The National Priorities List is a list of sites being cleaned up pursuant to the Comprehensive, Environmental Response, Compensation, and Liability Act. This list is maintained and updated by the U.S. Environmental Protection Agency. Federal and state officials work together to determine priority sites and submit candidate sites for inclusion on the National Priorities List. The National Priorities List includes the sites with the highest priority for further investigation pursuant to the federal Superfund Program. Candidate sites are ranked on a scale of 0 to 100, using a numerical scoring system known as the Hazard Ranking System. The system evaluates the threat a site poses to human health or the environment through contamination of soil, surface water, groundwater, or air. Hazardous waste sites with a quality-assured Hazard Ranking System score equal to or greater than 28.5 are eligible for inclusion on the National Priorities List. Sites for which the Center for Disease Control has issued a health advisory are also eligible, regardless of the score.

As of June 30, 2018, Missouri has 33 sites on the National Priorities List. Presented below is the list of those 33 Missouri sites and the corresponding site information web link. Of these 33 sites, ten are listed on the Registry. Registry sites are bolded.

NATIONAL PRIORITIES LIST SITES IN MISSOURI

1. Annapolis Lead Mine
Annapolis, Mo.
NPL List Date: July 22, 2004
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0702917>
2. Armour Road
2251 Armour Road
North Kansas City, Mo.
NPL List Date: May 10, 1999
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0702515>
3. Bee Cee Manufacturing Co.
Malden Industrial Park
Malden, Mo.
NPL List Date: June 10, 1986
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701439>
4. Big River Mine Tailings/
St. Joe Minerals Corp.
Sec. 25, 26, 35 & 46, T. 37N, R. 4E
Desloge, Mo.
NPL List Date: Oct. 14, 1992
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701639>
5. Compass Plaza
201 S. Marshall St.
Rogersville, Mo.
NPL List Date: March 15, 2012
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0706143>
6. Conservation Chemical Co.
8900 Front St.
Kansas City, Mo.
NPL List Date: Oct. 4, 1989
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0700777>
7. Ellisville Site
149 Strecker Road
Ellisville, Mo.
NPL List Date: Sept. 8, 1983
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701205>

8. Fulbright Landfill
Bolivar Road
Springfield, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0701153>
9. Lake City Army Ammunition Plant
(Northwest Lagoon)
Junction Highway 7 and Highway 78
Independence, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0701757>
10. Lee Chemical
Highway 210 east of Highway 291
Liberty, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0701378>
11. Madison County Mines
Fredericktown, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0701102>
12. Minker/Stout/Romaine Creek
4037 W. Rock Creek Road and Swaller Road
Imperial, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0701345>
13. Missouri Electric Works
S. Highway 61, two miles south of Highway K
Cape Girardeau, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0701474>
14. Newton County Mine Tailings
Various Locations
Newton County, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0701651>
15. Newton County Wells
3900 Rangeline Road
Joplin, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0702514>
16. Oak Grove Village Well
206 James St.
Oak Grove Village, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0700020>
17. Oronogo-Duenweg Mining Belt
Various Locations
Oronogo-Duenweg, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0701290>
18. Pools Prairie
Highway 60 and U.S. Highway 71
Neosho, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0702918>

19. Quality Plating NPL List Date: June 10, 1986
Route 2
Sikeston, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701442>
20. Riverfront NPL List Date: Dec. 1, 2000
New Haven, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0702089>
21. **Solid State Circuits, Inc.** NPL List Date: June 10, 1986
Main St.
Republic, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701392>
22. Southwest Jefferson County Mining NPL List Date: Sept. 23, 2009
166 sq. miles in southwest quarter of Jefferson County
De Soto, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0705443>
23. St. Louis Airport/HIIS/Futura Coatings Co. NPL List Date: Oct. 4, 1989
Brown Road north of Airport
Hazelwood, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701210>
24. **Syntex Facility** NPL List Date: Sept. 8, 1983
First St.
Verona, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0700881>
25. Valley Park TCE NPL List Date: June 10, 1986
Highway 141 north of Meramec River
Valley Park, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701494>
26. Vienna Wells NPL List Date: Sept. 29, 2010
545-547 N. Chestnut St.
Vienna, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0705803>
27. Washington County Lead District-Furnace Creek NPL List Date: April 11, 2011
Two miles north of intersection of Big River and Highway 21
Caledonia, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0705842>
28. Washington County Lead District-Old Mines NPL List Date: March 19, 2008
Intersection of Highway 21 and Highway 47
Old Mines, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0705027>
29. Washington County Lead District-Potosi NPL List Date: March 19, 2008
500 feet east of Bell St. and Valley Road
Potosi, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0705023>

30. Washington Co. Lead District-Richwoods
21 acres in northeast Washington County
Richwoods, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0705032>
31. Weldon Spring Former Army Ordnance Works
Highway 94, south of U.S. 40
Weldon Spring, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0701773>
32. Weldon Spring Quarry/Plant/Pits
Highway 94, two miles south of U.S. 40
Weldon Spring, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0701753>
- 33. West Lake Landfill**
13570 St. Charles Rock Road
Bridgeton, Mo.
<https://cumulis.epa.gov/supercpad/cursites/csinfo.cfm?id=0701039>
- NPL List Date: Aug. 30, 1990**

CLEANUPS

Registry Consent Agreements

Some owners whose property is proposed for the Registry would prefer to remediate a site to Class 5 rather than allow it to be placed on the Registry. Site owners or potential responsible parties wishing to clean up a site may negotiate a Registry Consent Agreement with the Department. The consent agreement establishes a schedule and specific responsibilities for the completion of site investigation and remediation by the property owner or responsible party. All activities are completed with the Department's oversight. Upon successful completion of site remediation, the Department withdraws its Registry action.

As of June 30, 2018, responsible parties were cleaning up eight sites pursuant to state Registry Consent Agreements. These sites are identified in the following list.

- | | |
|---|---|
| 1. Emerson Electric
8100 W. Florissant
St. Louis, MO 63136 | 6. SKF Foundry
1801 W. Main St.
Washington, MO 63090 |
| 2. Joplin Pipe & Steel
506 Tyler Ave.
Joplin, MO 64801 | 7. Toastmaster Kirksville
1301 N. Osteopathy
Kirksville, MO 63501 |
| 3. Litton Systems
4811 W. Kearney St.
Springfield, MO 65803 | 8. TRW Manchester
14161 Manchester Road
Manchester, MO 63011 |
| 4. Missouri Metals
9970 Page Blvd.
Overland, MO 63132 | |
| 5. Orbco (Orscheln)
1177 N. Morley
Moberly, MO 65270 | |

REGISTRY SITES REMOVED OR ACTION SUSPENDED

The following table lists sites that were removed from the Registry, or Registry action was suspended.

	Site	Address	Date Proposed for Registry	Date Registered	Date Removed from Registry	Date Registry Action Suspended
1	Abrahamson Property	4044 West Rock Creek Rd, Imperial, MO 63052	2/11/84	6/14/84	9/26/86	NA
2	Acetylene Gas	3529 Hickory St., St. Louis, MO 63104	9/25/86	3/10/87	2/12/97	NA
3	Armco Union Wire Rope Plant	2100 Manchester Trafficway, Kansas City, MO 64126	7/27/89	NA	NA	1/20/93
4	Arneson Timber	Steelville, MO 65565	2/4/99	7/1/99	8/11/09	NA
5	AT&T	777 N. Blue Highway, Lee's Summit, MO 64063	12/27/89	NA	NA	9/3/92
6	Baxter Garden Center	17259 Wild Horse Creek Road, Chesterfield, MO 63005	8/26/83	1/1/84	2/18/97	NA
7	Bemis Company	1295 North Highway Dr., Fenton, MO 63026	10/20/87	NA	NA	6/17/10
8	Boulder Valley Campground	Highway AA, four miles southwest of Highway H, Syenite, MO 63640	4/18/85	NA	NA	5/1/85
9	Branson Quarry	Highway 65, three miles north of Branson, Branson, MO 65616	8/27/83	1/5/84	1/15/91	NA
10	Bristol Steel	3117 S. Big Bend Blvd., Maplewood, MO 63143	1/19/88	NA	NA	4/14/91
11	Bubbling Springs Arena	1300 Romaine Creek Rd., Fenton, MO 63026	8/26/83	1/9/84	9/18/89	NA
12	Bull Moose Tube Company	406 Industrial Dr., Gerald, MO 63037	8/26/83	NA	NA	2/5/98
13	Burlington Northern Railroad - Cottrell Property	Highway 19 N. of Cherryville, Cherryville, MO 65446	1/25/96	3/25/96	10/6/00	NA
14	Burlington Northern Railroad - Crider Property	Highway 19 and Becker, Steelville, MO 65565	1/30/96	9/26/96	8/1/04	NA
15	Burlington Northern Railroad - Richards Property	HC 86 Box 6151, Steelville, MO 65565	1/27/96	NA	NA	8/29/00
16	Burlington Northern Railroad - Wright Property	Highway 19, half mile south of Cherryville, Cherryville, MO 65446	2/9/86	4/11/96	10/31/00	NA
17	Cashel Residence	2306 Romaine Creek Rd., Fenton, MO 63026	8/27/83	NA	NA	10/4/85
18	Castlewood (Sontag Road Swim Club and Fire Station)	1000 New Ballwin Rd., Ballwin, MO 63021	8/26/83	1/3/84	11/1/87	NA
19	Community Christian Church	623 Meramec Station Rd., Manchester, MO 63021	8/26/83	NA	NA	2/5/98

	Site	Address	Date Proposed for Registry	Date Registered	Date Removed from Registry	Date Registry Action Suspended
20	Cooksey's Barrel	Route 1, Village Ridge, MO, 63089	8/27/83	6/14/84	4/19/93	NA
21	Craft World International	603 W. Plainview Rd., Springfield, MO 65807	4/5/88	NA	NA	6/20/89
22	Defiance Dump Site #1	Near 643 Old Colony Rd., Defiance, MO 63341	8/27/83	NA	NA	4/10/84
23	Detroit Tool	100 Carr St., Lebanon, MO 65536	3/12/90	NA	NA	12/22/95
24	Dexter Plating	Arvin Rd., Dexter, MO 63841	8/8/86	NA	NA	9/3/92
25	Dora Post and Lumber Co	Highway 181, Dora, MO 65637	3/7/03	4/18/03	4/21/08	NA
26	Dorman's Industry	Highway 254, Galmey, MO 65779	6/18/87	8/17/87	2/1/06	NA
27	East North Avenue	E. North St., Williams Rd., Eureka, MO 63025	2/9/84	NA	NA	2/5/88
28	East Texas Motor Freight	119 Douglass St., St. Louis, MO 63147	6/24/96	NA	NA	2/5/98
29	Eggman Drum	6.4 miles south of the intersection of Routes 8 and 21, Potosi, MO 63116	3/7/86	3/16/87	12/28/90	NA
30	Ellisville-Rosalie Property	Wildwood, MO 63011	8/27/83	9/21/84	9/8/87	NA
31	Erwin Farm	1.5 miles north of Verona, Verona, MO 65707	8/27/83	1/3/84	10/9/87	NA
32	Fire Trail 11-H	Steelville, MO 65565	5/17/84	NA	NA	8/1/84
33	Folk Avenue	7882 Folk Ave., Maplewood, MO 63143	2/9/84	NA	NA	11/15/07
34	Frontenac (Bliss Tank Farm)	German Blvd. and Dwyer Lots, Frontenac, MO 63131	8/26/83	3/19/90	3/30/98	NA
35	Fulbright Landfill	Boliver Rd, Springfield, MO 65802	8/29/83	1/1/84	6/30/16	NA
36	General Electric/Enterprise Park	2401 Sunshine St. Springfield, MO 65804	7/29/85	NA	NA	3/3/88
37	Generally Hauling	2.5 miles east off Route 47 on Route TT, St. Clair, MO 63084	6/10/87	8/17/87	11/2/99	NA
38	Great Lakes Container Corp	42 Ferry St., St. Louis, MO 63147	2/5/88	NA	NA	6/27/88
39	Grimco Signs	1 L and D Dr., Owensville, MO 65066	2/4/88	NA	NA	1/5/90
40	Hamill Transfer	3225 Chouteau Ave., St. Louis, MO 63103	8/29/83	9/3/85	2/12/87	NA
41	Hardt Road	18538 Hardt Rd., Glencoe, MO 63021	8/27/83	2/22/85	12/1/87	NA
42	Hellwig Fruit Stand	7800 Chesterfield Airport Rd., Chesterfield, MO 63005	6/1/90	NA	NA	5/12/92

	Site	Address	Date Proposed for Registry	Date Registered	Date Removed from Registry	Date Registry Action Suspended
43	Hendren Salvage Yard	705 Proctor Dr., Columbia, MO 65202	1/23/88	NA	NA	7/31/88
44	International Paper	2609 S. Rangeline, Joplin, MO 64801	2/9/1984	6/14/1984	6/30/2014	NA
45	Kem-Pest Laboratories	East of State Highway 177, Cape Girardeau, MO 63701	3/17/87	NA	NA	10/26/00
46	King Adhesives	5231 Northrup Ave., St. Louis, MO 63110	5/30/02	6/23/03	1/26/06	NA
47	Kramer	2101 Old Bismarck Rd., Park Hills, MO 63601	8/11/89	NA	NA	4/10/97
48	Lacy Manor Development (Sandcut Road)	403 B Sandcut Rd., Catawissa, MO 63016	8/26/83	12/27/85	10/28/87	NA
49	Manchester United Methodist Church	Manchester, MO 63011	1/1/84	1/1/84	11/24/92	NA
50	Minker/Stout/Romaine Creek	4037 W. Rock Creek Rd., Hillsboro, MO 63052	2/13/84	6/14/84	7/26/99	NA
51	Moberly FMGP	501 Franklin St., Moberly, MO 65270	11/20/02	1/14/03	6/30/14	NA
52	Modern Iron And Metals	7101 N. Market St., Pagedale, MO 63133	6/10/87	8/17/87	8/27/91	NA
53	Monsanto-Queeny	1700 S. Second St., St. Louis, MO 63177	2/13/84	NA	NA	4/10/97
54	Motoroloa-Webb City	17th and W, Hall St., Webb City, MO 64804	6/24/86	NA	NA	6/29/00
55	Nevada Landfill	Nevada, MO 64772	1/30/86	NA	NA	12/4/86
56	Parkhurst Mfg. Co.	2503 W Broadway Blvd., Sedalia, MO 65301	8/29/83	NA	NA	11/1/83
57	Payne Residence	4038 Rock Creek Rd., Imperial, MO 63052	8/27/83	1/3/84	10/1/86	NA
58	Piazza Road/Bliss Farm	Rosati, MO 65559	8/26/83	3/10/87	12/28/90	NA
59	Plattco Landfill – Douglass property	Parkville, MO 64152	4/19/85	NA	NA	7/15/87
60	Private Drive Off Highway 100	Boone's Lane, Junction Highway 100 and T, Glencoe, MO 63017	2/10/84	6/14/84	1/15/88	NA
61	Quail Run Mobile Manor	E. Highway 100, Gray Summit, MO 63055	8/26/83	NA	NA	3/17/89
62	Quality Metal Finishing-Commercial Ave.	2055 N. Commercial Ave., St. Clair, MO 63077	8/14/03	10/13/03	3/2/12	NA
63	Ray County Drum	2.5 miles east of Regal, Regal, MO 64035	5/25/84	NA	NA	5/1/85
64	Reeves Property	Fredericktown, MO	5/20/87	NA	NA	11/15/93

	Site	Address	Date Proposed for Registry	Date Registered	Date Removed from Registry	Date Registry Action Suspended
65	Robbins Property	Route 3, Highridge, MO 63049	2/10/84	6/14/84	12/9/92	NA
66	Roscoe	Roscoe, MO 64776	1/23/89	NA	NA	4/27/00
67	Rusha Farm	One mile southwest of Verona, Verona, MO 65712	8/27/83	1/3/84	9/8/87	NA
68	Sac River Landfill	Hwy 13, Springfield, MO 65802	8/26/83	1/15/84	6/30/16	NA
69	Saddle & Spur Riding Club	Little Antire Creek Rd., Highridge, MO 63049	8/27/83	1/15/84	8/9/90	NA
70	Saline Creek Site	3/4 mile northeast of Murphy, Murphy, MO 63206	8/27/83	NA	NA	6/1/84
71	Shenandoah Stables	Highway 61 S., Moscow Mills, MO 63362	8/30/83	1/3/84	8/21/89	NA
72	Solid State Circuits -Boonville Road	616 Boonville Rd., Springfield, MO 65806	7/12/90	NA	NA	8/26/96
73	Southern Cross Lumber	143 McDonnell Blvd., Hazelwood, MO 63042	8/31/83	2/22/85	3/9/88	NA
74	Southwestern Bell/Eureka	Stonegate and Williams Rds., I-44, Eureka, MO 63025	3/17/87	NA	NA	4/27/00
75	Star Brite Plating-Joplin (Mid States Motor Carriers Inc.)	610 Tyler Ave., Joplin, MO 64801	5/16/90	NA	NA	4/27/00
76	Star Brite Plating-Joplin	510 Tyler Ave., Joplin, MO 64801	5/15/90	NA	NA	8/5/03
77	Stephens Farm	13688 Ozark Rd., Neosho, MO 64850	3/8/91	5/23/91	1/4/99	NA
78	Sullins Residence	1680 Romaine Creek, Fenton, MO 63026	8/27/83	NA	NA	10/10/85
79	Talley Farm	McKinley, MO 65705	2/8/84	NA	NA	12/3/85
80	Timberline Stables	Route MM, New Bloomfield, MO 65063	8/29/83	1/1/84	1/29/89	NA
81	Times Beach	I-44 east of Eureka, Times Beach Disincorporated, MO 63025	3/5/84	4/5/84	4/28/99	NA
82	TSI Mulberry Hill Road	Mullberry Hill Rd., Barnhart, MO 63051	9/3/83	1/3/84	1/18/91	NA
83	TWA (Ground Operations Center)	KCI Airport, Kansas City, MO 64153	10/14/86	NA	NA	6/14/01
84	Wheeler Property	107 E. Pine, La Monte, MO	8/29/83	NA	NA	9/17/84
85	Wheeling Disposal	Off Hwy K, one mile south of Amazonia Amazonia, MO 64421	8/29/1983	1/1/1984	6/30/2016	NA

**REGISTRY OF CONFIRMED
ABANDONED OR
UNCONTROLLED HAZARDOUS
WASTE DISPOSAL SITES
FISCAL YEAR 2018**

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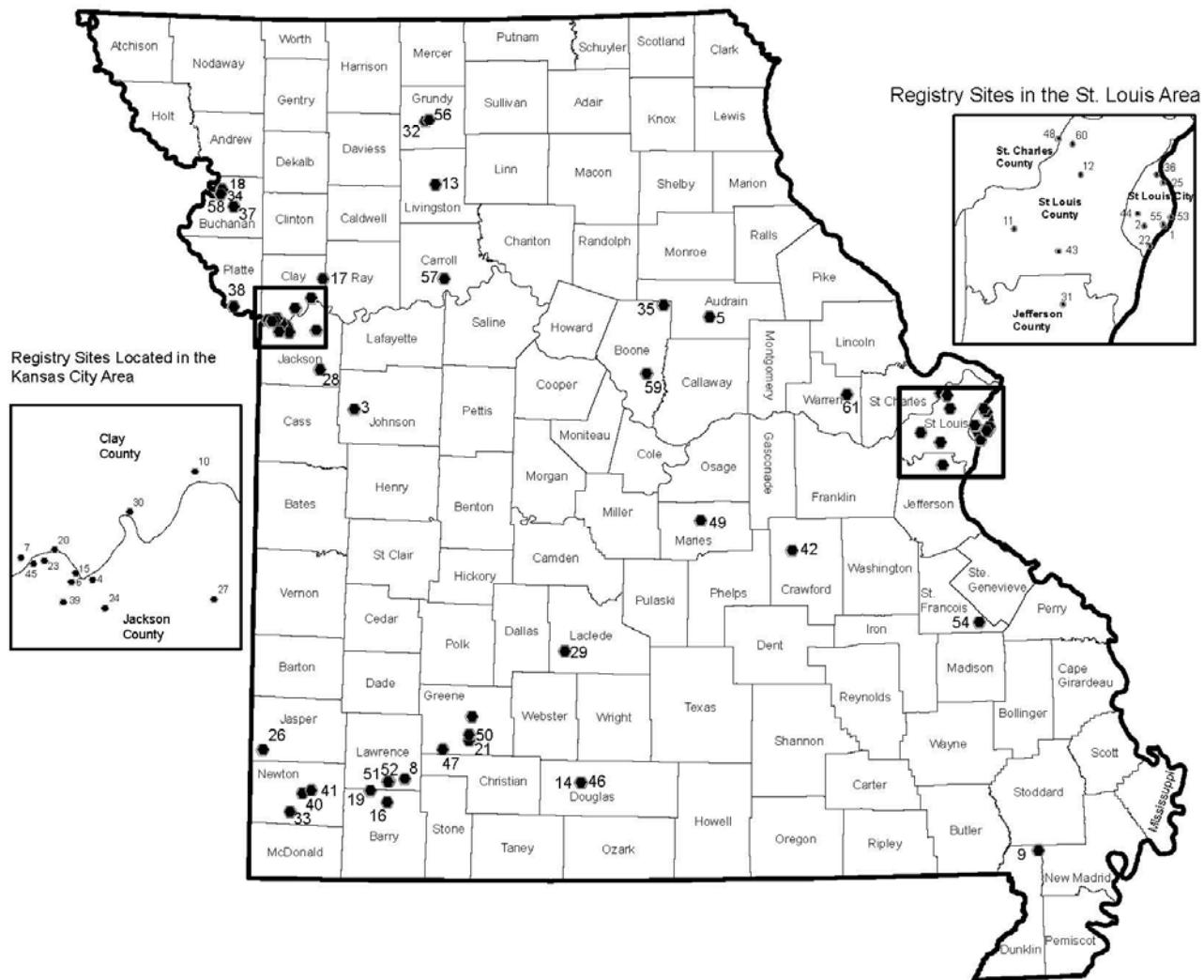
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Registry Site Location Map FY 2018

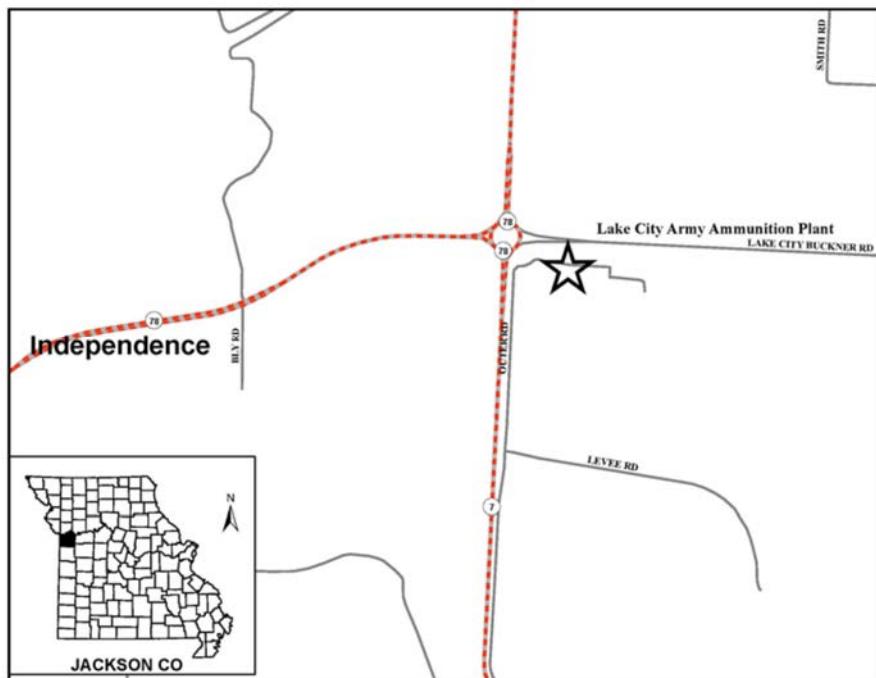
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CLASS 1 SITES

Lake City Army Ammunition Plant



Site Name: Lake City Army Ammunition Plant

Classification: Class 1

Date of Registry Placement: March 2, 2001

Date of National Priorities List Listing: July 22, 1987

Site Address: The junction of Highway 7 and Highway 78 near Independence, Jackson County, Mo.

Present Property Owner: U.S. Government, Department of the Army

Lead Agency: U.S. Environmental Protection Agency

Waste Type: Metals: antimony, arsenic, cadmium, lead, mercury; Volatile organic compounds: trichloroethylene (TCE), tetrachloroethylene (PCE), 1,1,2-trichloroethane, vinyl chloride, 1,2-dichloroethene, 1,1,1-trichloroethane, toluene; Semi-volatile organic compounds: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene; Explosives: 1,3,5-trinitro-1,3,5-triazine, 1,3-DNB, 2,6-dinitrotoluene, lead styphnate and Trinitroresorsinol; Radioactives: Depleted uranium

Quantity: Area 18 Operable Unit - 1.3 to 2.2 million pounds volatile organic compounds in subsurface. Northeast Corner Operable Unit - 0.74 to 1.5 million pounds volatile organic compounds in subsurface. Other areas not estimated.

Site Description: The Lake City Army Ammunition Plant is a 3,935-acre government-owned, contractor-operated plant that began operation in 1941. It is the largest small arms ammunition plant in the nation. Industrial operations generated large quantities of potentially hazardous waste, including solvents; explosives; heavy metals such as barium, cadmium, chromium, lead, mercury, and silver; and depleted uranium. Since 1941, the facility disposed of operational wastes in lagoons, landfills, and burn pits located throughout the six-square-mile facility. Current disposal practices are now subject to state and federal regulations.

Environmental Problems and Areas of Concern:

The site is located in a former channel of the Missouri River and flood plain. Groundwater, surface water, and soil are contaminated with volatile organic compounds, explosives, and heavy metals. Contaminants associated with a groundwater plume in the northeast corner previously migrated past the facility's

boundary but currently is hydraulically contained on site by a groundwater pump-and-treat system. A former building, known as Building 83, was contaminated with explosive materials in the porous areas and open conduits within the building structure, but was remediated and demolished.

The Department completed the third five-year review for the site, which identified vapor intrusion as an additional potential exposure pathway. Results of sampling indicate low risk of exposure via vapor intrusion for the current building occupants. Additional sub-slab monitoring will be conducted through the 2020 five-year review.

Remedial Action:

The ammunition plant is divided into 34 areas of concern, which compose five operable units: the Northeast Corner Operable Unit, the Area 18 Operable Unit, Area 10 Sand Piles Operable Unit, the Installation-Wide Operable Unit, and Building 83 Operable Unit.

Northeast Corner Operable Unit: The Northeast Corner Operable Unit consists of Areas 11, 16, and 17 and two areas governed by the Resource Conservation and Recovery Act. A Record of Decision for remedial action was signed September 2007. Remedies for Areas 17B, and 17D continue to be evaluated. A 2018 Timeframe Memo concluded that the selected remedies for these Areas will result in unacceptable remedial timeframes greater than 100 years. Other remedial technology options will be evaluated beginning in a 2019 Army contract for determination and selection of alternate remedial technologies that can meet remedial design criteria. The selected remedy for each of the areas in the Northeast Corner Operable Unit includes:

Resource Conservation and Recovery Act Areas: Waste Oil and Solvent Storage Facility and Paint and Solvent Waste Storage Facility – Surficial Soil – excavation and off-site disposal of surficial soil with chemicals of concern that exceed cleanup goals. Institutional controls are required to maintain industrial land use.

Area 11 Burning Ground: Surficial soil – institutional controls are required to maintain industrial land use. Groundwater – monitored

natural attenuation for cyclonite and perchlorate and institutional controls are required to prevent groundwater use and maintain industrial land use.

Area 16A Abandoned Landfill: Groundwater – monitored natural attenuation for semi-volatile organic compounds and institutional controls to prevent groundwater use and maintain industrial land use, groundwater seeps – groundwater seep monitoring to ensure compliance with cleanup goals, landfill cover inspection and maintenance, and institutional controls related to the landfill management (e.g., no construction of buildings on landfill) and to maintain industrial land use.

Area 16B Solvent Pits – enhanced reductive dechlorination via an in-situ reactive zone in the source area, Groundwater- monitored natural attenuation, and institutional controls to prevent groundwater use, prevent activities that could result in vapor exposure, and maintain industrial land use.

Area 16C (Old Firing Range), 16D (Old Burning Grounds), and 17C (Burning Pad) – surficial soil – lead hot spots excavation and consolidation with soil in Area 17D. Institutional controls are required to maintain industrial land use.

Area 17D Waste, Glass, Paint, and Solvents Area – focused excavation and consolidation of lead-impacted soil in areas susceptible to erosion; in-situ stabilization or excavation and off-site disposal of lead-impacted surficial soil with concentrations greater than 10,000 parts per million; vegetative cover of lead-impacted surficial soil exceeding the cleanup goal of 1,197 parts per million; vegetative cover over litter; litter removal; maintenance and performance monitoring of the permeable reactive wall; enhanced reductive dechlorination source treatment via an in-situ reactive zone; phyto-system to minimize surfacing of groundwater near the permeable reactive wall and to provide hydraulic control of groundwater flow near the permeable reactive wall; monitored natural attenuation; operation of Well 17-S; and institutional controls to prevent activities that could result in vapor exposure, prevent building/construction on soil covers, and maintain industrial land use.

Area 17B Oil and Solvent Pits – Zero Valent Iron source treatment via deep soil mixing;

maintenance/repair of the existing vegetative cover to minimize infiltration; enhanced reductive dechlorination source treatment via an in-situ reactive zone; monitored natural attenuation within source area to monitor ongoing enhanced reductive dechlorination processes; sentinel/monitoring wells to monitor for non-aqueous phase liquid migration; monitored natural attenuation of the downgradient groundwater volatile organic compound plume; enhanced reductive dechlorination via an in-situ reactive zone barrier to prevent migration of the volatile organic compound plume to the paleochannel and increase rate of plume degradation; and institutional controls for restriction of land use and prevention of consumption of contaminated groundwater.

Area 18 Operable Unit: Area 18 consists of a series of oil and solvent pits and burn areas where a large quantity of spent solvents and other wastes were disposed. The original ROD was signed in 1999. During post-1999 ROD activities, site conditions were found to be different than originally thought and an amended ROD was completed in 2007.

In support of the Record of Decision amendment, additional investigation activities were conducted to further understand the nature and extent of contamination. The investigation discovered additional Impacts to surface soil and the volatile organic compound source area mass. The volume of surface soil with lead above the cleanup goal increased from 4,700 cubic yards to approximately 9,700 cubic yards. The volatile organic compound contaminant mass in the source area increased from less than 50,000 pounds delineated to only 20 feet below to a low-range estimate of more than 1,000,000 pounds delineated to approximately 30 feet below ground surface. The dominant factor accounting for the increase of the volatile organic compound mass estimated to be present in Area 18 Operable Unit is the presence of non-aqueous phase liquid in the shallow volatile organic compound source areas.

The remedies for Area 18 Operable Unit currently are being implemented and are as follows:

- Focused in-situ stabilization of lead-impacted surface soil.

- Installation of in-situ reactive zone barriers in the paleochannel downgradient of each volatile organic compound source area to contain the source.
- Focused soil excavation, installation of non-aqueous phase liquid recovery wells, monitored natural attenuation, and in-situ reactive zone treatment in the volatile organic compound source areas.
- Installation of a vegetative cover to limit the potential for exposure to lead-impacted surface soil and impacted soil in the volatile organic compound source areas.
- Continued operation and optimization of the existing on-site groundwater extraction and treatment system and monitored natural attenuation of groundwater.
- Land use controls to limit the potential for exposure to lead-impacted surface soil and impacted soil and groundwater in the volatile organic compound source areas.

The Interim Remedial Action Completion Report was finalized for Area 18 and the Installation-Wide Operable Unit in June 2010.

Installation-Wide Operable Unit: The Installation-Wide Operable Unit encompasses the remainder of the facility (about 30 areas of concern) except for the Area 10 Sand Piles and Area 27 (active firing range). The selected remedy consists of Monitored Natural Attenuation with Land Use Controls to ensure land use remains Industrial and groundwater use is restricted..

In 2008, EPA and the Responsible Parties signed the Record of Decision for the Installation-Wide Operable Unit and the selected remedies were as follows:

Area 2: Focused soil excavation and off-site disposal of lead-impacted soil to prevent potential exposure to site and construction workers and to prevent potential leaching to groundwater.

Area 3: Vegetative cover and land use controls to prevent potential exposure of human and ecological receptors to

polynuclear aromatic hydrocarbons and metals-impacted soils.

Area 9: Focused soil excavation and off-site disposal of lead- and TCE-impacted soil to prevent potential exposure to site workers.

Area 13: Focused soil excavation and off-site disposal of metals-impacted soil to prevent potential exposure to site workers.

Area 23: Implementation of land use controls to protect construction/utility workers from potential exposure to manganese in wind-blown fugitive dust.

Area 30: Vegetative cover and land use controls to prevent potential exposure of human and ecological receptors to metals-impacted soils.

Area 34: Focused soil excavation and off-site disposal of metal and explosive-impacted sediment to prevent potential exposure of ecological receptors to sediment and to prevent potential leaching to groundwater.

Areas 4, 7, 13, 15, 19, 21, and 33: Land use controls are necessary to prevent exposure to contaminated soil associated with inactive sumps that are located next to production buildings or areas that prohibit removal of the sumps at this time. The following sumps require future work and will be addressed as they become available through maintenance or construction activities, or at installation closure or transfer: 1SU2, 3SU3, 33CSU1, 33DSU1, 34BSU1, 34DSU1, 52ASU1, 52BSU1, 97ASU2, and 136ASU1. In addition, five inactive sumps at Area 13 have been abandoned beneath buildings (35SU10 through 35SU14). These sumps are presumed to have been filled or removed during construction activities and were not addressed as part of the removal action. If in the future it is determined that these sumps require additional work, they will be addressed as access to them becomes available due to construction, maintenance, or at installation closure or transfer.

Installation-Wide Operable Unit - Wide Groundwater: Monitored natural attenuation, land use controls, groundwater extraction and ex-situ treatment, and installation of an in-situ treatment system at Area 12 via enhanced reductive dechlorination to prevent potential exposure of human receptors to groundwater.

The Interim Remedial Action Completion Report was finalized July 2010.

Area 10 Sand Piles Operable Unit: The Area 10 Sand Piles Operable Unit originally was slated to be remediated under a Nuclear Regulatory Commission Decommissioning Plan. Due to the underestimation of waste material, the project did not receive the required funding. The Nuclear Regulatory Commission deferred regulatory oversight to EPA Region 7 and the Department. Major contaminants of concern include depleted uranium, lead, and unexploded ordnance. The Federal Facility Agreement Parties made up of the Army, EPA, and the Department agreed to make Area 10 Sand Piles a separate operable unit. In 2005, the Army, EPA, and the Department agreed to pursue a Non-Time-Critical Removal Action to address chemical and radiological contamination at Area 10. The Army issued the Area 10 Sand Piles Engineering Evaluation/Cost Analysis October 2005. This document presented the basis for the proposed removal action by characterizing the current site conditions and associated risks, evaluating potential removal action alternatives, identifying cleanup levels, and recommending a suitable removal action approach to address the lead- and depleted uranium-impacted sand and soils.

In January 2008, the EPA and the Department prepared an Explanation of Significant Difference to document a revised cleanup level for lead consistent with the ammunition plant's site-wide cleanup level under an industrial scenario. A Revised Final Area 10 Sand Piles Action Memorandum was issued August 2008 to document regulatory approval of both the Non-Time Critical Removal Action outlined in the Engineering Evaluation/Cost Analysis and the final cleanup level for lead under an industrial scenario. The removal action was completed by December 31, 2008, on the bullet catcher sand piles addressing radioactive materials, required as part of the decommissioning activities, and nonradioactive constituents. A Removal Action Completion Report and Final Status Survey were completed March and June 2009. The material was hand-sorted and the unexploded ordnance hydrocut to render it non-explosive. All other waste streams from the sorting and cleanup process have been shipped and disposed. In 2015, an amendment to the ammunition plant's Nuclear Regulatory Commission license occurred.

Building 83 Operable Unit: Building 83 was added as an additional operable unit - Operable Unit 5. Constructed around 1942, the Army used Building 83 as a previous production building for Trinitroresorsonil. Trinitroresorsinol is the precursor to lead styphnate, an explosive propellant used in the production of ammunition. The process of producing Trinitroresorsinol involves the use of various types of acids. During the time period the Army used this building for production, it is believed the fuming of the acid during the process carried explosive contamination into the porous areas and open conduits in the building structure. Once the material dried, it formed crystals in both accessible and inaccessible areas, making remediation difficult. The building was considered very dangerous with a high explosive potential. The contaminants of concern for this building were asbestos, mercury, lead, PCBs, and explosives. The building contained both friable and non-friable asbestos. Demolition of Building 83 was completed July 2017. Subsoil testing confirmed no contamination greater than background levels. Land Use Controls remain. The area was backfilled, graded, and seeded. Site restoration is complete. The Department and EPA will continue area inspections.

General Geologic and Hydrologic Setting:

The site is located near the boundary between the Osage Plain and Dissected Till Plains of the Central Lowland Physiographic Province. The surface topography in the vicinity of the plant consists of rolling uplands traversed by broad stream valleys and flood plains of the Missouri River, the Little Blue River, and an abandoned Missouri River channel. The majority of the active manufacturing areas are situated in the topographically flat portion of the site. Surface water draining from the western portion flows to West Fire Prairie Creek and eventually into the Little Blue River. Surface drainage from the eastern portion flows to East Fire Prairie Creek and eventually into the Missouri River.

At the highest elevations, limestone of the Pennsylvanian-age Kansas City Group is the predominant bedrock. Underlying side slopes, shale and claystone with lesser amounts of limestone of the Pennsylvanian-age Pleasanton Group dominate. Bedrock beneath the alluvial channel is limestone of the Pennsylvanian-age Marmaton Group. Soils

overlying bedrock in the upland area range in thickness from two to five feet and typically are composed of silty clay and silt. In the central and northern parts of the installation the soils are composed of silty clay and silt about five feet thick. Pleistocene-age alluvial deposits of silt, clay, sand, and gravel fill the abandoned Missouri River channel to depths up to 90 feet.

The principal aquifer of Lake City and the site area is the unconsolidated Pleistocene-age alluvial deposits, specifically the coarse sand and gravel in the lower 40 to 70 feet, located in the abandoned Missouri River channel. Lake City residents and the site use the alluvial aquifer for basic drinking and industrial water needs. The pumping of production wells has altered the natural groundwater flow patterns. The non-pumping groundwater flow directions were reported to have been to the east and west with a groundwater flow divide near the central portion of the site. Recent potentiometric data indicate an apparent northwest-southeast groundwater flow divide located along the eastern quarter of the abandoned Missouri River channel. West of the divide, groundwater flows in a generally westward direction (influenced by site pumping) within the abandoned channel.

Across the site, the average depth to the water table is five feet below the ground surface in the alluvial flats. The average depth to the water table in the uplands is seven feet below the ground surface. The site alluvial aquifer is in hydraulic connection with the Little Blue River alluvium and the Missouri River alluvium. The principal concern is the potential for lateral off-site migration of hazardous wastes through the alluvial materials. Groundwater in the Pennsylvanian-age bedrock underlying the site is a minor component of the overall regional groundwater flow regime.

Public Drinking Water Advisory:

Twelve active public drinking water wells provide water to the Lake City Army Ammunition Plant facility, with all wells drawing water from a shallow alluvial aquifer that underlies the site. Site-related contamination has not affected any system wells, but a risk does remain. The northwest lagoon area of the site is located nearly at the center of concentration of the well field and lies within one-half mile of six of the twelve

wells. Alluvial aquifers often exhibit relatively rapid groundwater flow – it is possible that dramatically increased (or decreased) pumping from one or several wells could alter the groundwater flow regime and influence lateral or vertical migration of contaminated groundwater. Due to verified surficial and groundwater contamination at the site and the spatial distribution of wells relative to on-site contamination, all twelve system wells are considered highly vulnerable to contamination.

Health Assessment:

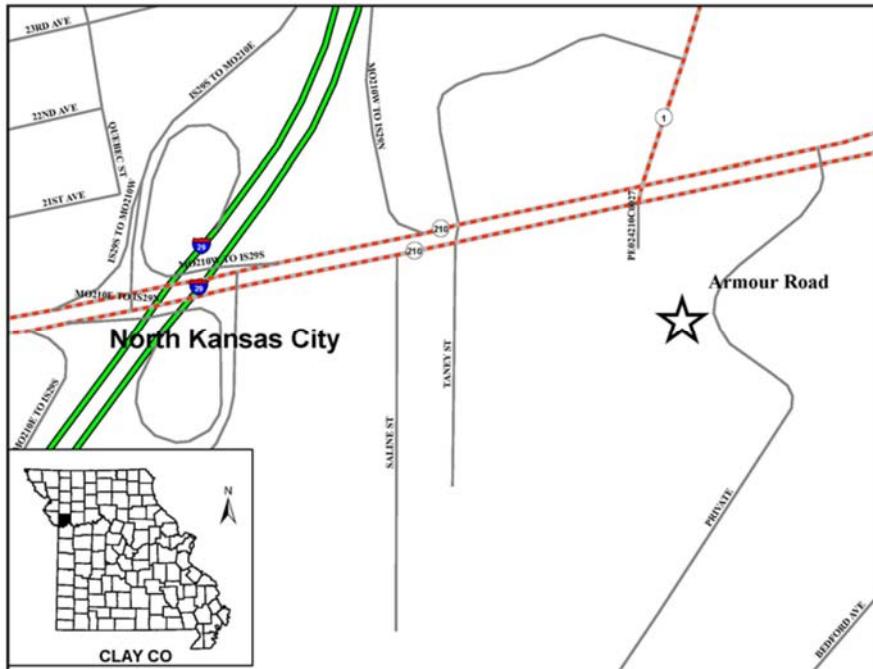
The following are the major contaminants of concern found in surface water, groundwater, or soil at the site: antimony, arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, cadmium, 1,2-dichloroethene, 1,3-DNB, lead, PCE, toluene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, TCE, vinyl chloride, and 1,3,5-trinitro-1,3,5-triazine. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Due to the toxicity of the hazardous chemicals, surface soil, subsurface soil, and groundwater contamination, a health risk exists on site. A health risk may exist off site. Further groundwater and private well monitoring to determine the extent of the off-site migration of hazardous wastes will enable health officials to determine potential human exposure. Private well monitoring from 2004 through 2014, found no wells with contamination above the established standards. However, due to the number of contaminant sources around the plant and the number of conduits to groundwater, the risk of contamination to drinking water supply remains very high.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

CLASS 2 SITES

Armour Road



Site Name: Armour Road

Classification: Class 2

Date of Registry Placement: May 22, 1997

Date of National Priorities List Listing: May 10, 1999

Site Address: 2251 Armour Road, North Kansas City, Clay County, Mo.

Present Property Owners: North Kansas City

Lead Agency: U.S. Environmental Protection Agency (EPA)

Waste Type: Arsenic; pentachlorophenol (PCP); antimony; 2,4-dichlorophenoxyacetic acid (2,4-D); and other contaminants resulting from herbicide blending operations including benzo(a)pyrene; cadmium; dichlorophenol; lead; mercury; selenium; thallium; 2,4,5-trichlorophenoxyacetic acid (2,4,5-T); and 2,4,6-trichlorophenoxyacetic acid (2,4,6-T).

Quantity: U.S. Borax removed and disposed of approximately 1,400 tons of building material during a demolition action in 2004, and about 70,000 tons of contaminated soil was excavated, treated, and disposed in

2006. Rio Tinto, the responding party since 2009, removed an additional 44,241 tons of soil in 2017 along the western boundary and from under a roadway along the eastern border of the site. The quantity of contaminated groundwater is unknown but may range into the billions of gallons.

Site Description: The property covers approximately 1.8 acres, and the former facility on the property has had three owners and three operators. An herbicide blending facility was operated on the largest portion of the property from at least 1929 until 1986. The chemicals used in the herbicide blending included pentachlorophenol; sodium chlorate; 2,4-dichlorophenoxyacetic acid; and 2,4,5-trichlorophenoxyacetic acid. Herbicides blended at the facility were used for weed control along railroad rights-of-way.

Owners were the Reade Manufacturing Company (Reade) from 1929 to 1968, Habco (formerly known as Horne-Boatwright Chemical Company) from 1968 to 1986, and K.C. 1986 from 1986 to 2012. In 2012, the City of North Kansas City purchased the property. The operators were Reade, operating the facility from at least 1929 until November 1963; U.S. Borax Inc. (Borax), operating from November 1963 until November 1968 (Borax operation leased from Reade); and Habco, operating from 1968 until

until 1986. K.C. 1986 purchased the facility in 1986.

The site property was contaminated with extremely high levels of arsenic and lower levels of numerous other substances. Groundwater also was contaminated. This contamination is believed to be a result of spills and general operational practices at the facility. The 25,000-square-foot building, demolished in 2004, was also contaminated.

The site is located between an industrial area and a residential neighborhood. The property is adjacent to rail yard warehouses, industrial facilities, and a commercial development zone. Homes are about 1,200 feet away.

Environmental Problems and Areas of Concern:

The Missouri River alluvial aquifer that underlies the site has been contaminated. Analytical results from Missouri Department of Natural Resources sampling in June 1990 documented the presence of characteristic hazardous waste in the soil and groundwater. The analyses also documented the presence of hazardous waste constituents in the groundwater above health-based safe levels set for the site. The prevailing direction of groundwater flow is to the southeast toward the Missouri River. Based on current groundwater monitoring, arsenic in groundwater has not reached the Missouri River, and no down gradient water supply wells are located between the site and the Missouri River. Past groundwater use occurred at the former Treasure Chest Company well located about 1,300 feet southeast of the property, but the well is no longer in service.

Remedial Actions:

The Department conducted a first subsurface investigation study beginning in 1989. The Environmental Protection Agency (EPA) and the Department later conducted various investigation studies from 1989 to 1997 and additional soil studies until 2001. These studies documented exceptionally high arsenic concentrations in soil found at the surface of the site down to the water table, which was found at a depth of approximately 22-24 feet. When the Armour Road site was determined to contain exceptionally high

levels of arsenic concentrations, the EPA covered the exposed soil on the property with geo-fabric and gravel and placed a 6-foot-high, chain-link fence at the south and east borders of the property. In May 1999, the EPA added the site to the National Priorities List.

Beginning in 1996, U.S. Borax accepted the role as a responding party to address the soil source arsenic contamination on the property. Between October 2004 and June 2006, U.S. Borax decontaminated and removed buildings on the property, excavated soil to the water table at 24 feet, treated on-site soil as needed, and disposed of contaminated soil off site. Approximately 86,810 tons of soil containing a total of 1,990 tons of arsenic was removed from the property. Soils were excavated up to the site boundaries as close as practical, to a depth averaging 23 feet. Pockets of arsenic in soil remained because it was not possible to excavate the soil due to the proximity of a building (retail hardware store) located along the western property boundary and contamination near and under a service roadway along the southeastern border of the property.

Studies conducted by Rio Tinto documented a significant decline in the levels of arsenic concentration in the shallow groundwater interval compared to data from before the 2004 to 2006 removal action. Groundwater monitoring after the soil removal action further revealed that pentachlorophenol, 2,4,5-trichlorophenoxyacetic acid and 2,4,6-trichlorophenoxyacetic acid concentrations declined to non-detect levels, compared to the concentrations that had been detected in groundwater during the initial site investigations conducted in the 1990s. As a result of these findings, only arsenic would be considered a contaminant of a concern when evaluating future remedial groundwater alternatives for the site.

In May 2013, Rio Tinto completed its remedial investigation of soil and groundwater and then began a study of possible groundwater remedial alternatives, recognizing that a remaining soil source objective that could not be completed during the 2004 to 2006 would complicate the evaluation and selection of the groundwater remedy. In December 2014, Rio Tinto voluntarily agreed to remove the remaining soil source, to the extent possible, concurrently with a redevelopment plan

proposed by North Kansas City that would allow the remaining soil source contamination to be removed. In January 2017, a total of approximately 44,240 tons of contaminated soil had been excavated, with 19,080 tons removed from the service roadway area and 25,162 tons removed from the retail hardware store area. A total of 27,700 kilograms of arsenic was removed from the site. Once the removal action was completed, Rio Tinto committed to evaluating the overall effectiveness of this removal action and focusing on completing a feasibility study for groundwater.

In March 2018, Rio Tinto began a year long study designed to provide data to assess monitored natural attenuation as a response action for groundwater by conducting post-removal action (for soil) groundwater monitoring and documenting the monitored natural attenuation processes present at the site. The study follows a tiered investigative approach in accordance with EPA guidance policy.

General Geologic and Hydrologic Setting:

The Armour Road Site, located on an alluvial point bar on the north shore of the Missouri River, is characterized by 17 to 22 feet of silty clay interbedded with fine-grained sand and silt lenses. These materials are underlain by fine- to medium-grained sand to a depth of at least 55 feet. This sand interval within the Missouri River alluvial aquifer is saturated from a depth of 25 feet. Due to the thick alluvial cover, bedrock is not exposed. However, the underlying bedrock is of the Pennsylvanian-age Kansas City Group, which is 60 to 85 feet below the ground surface.

Groundwater at the site flows southeast through permeable sand and discharges into the Missouri River. The Missouri River alluvial aquifer is used widely in this area.

Public Drinking Water Advisory:

Five active alluvial public water wells used by North Kansas City are located approximately 1.3 miles west of the Armour Road site. Due to a southeast-trending groundwater flow pattern at the Armour Road site, contamination from this site will not likely influence these wells. Public drinking water sources used by Kansas City and the city of Gladstone include alluvial wells and a surface

water intake, all of which are upstream of the Armour Road site, while the city of Independence uses an alluvial well field located approximately 8 miles downstream from the site along the southern bank of the Missouri River. Although all of the alluvial wells in this region draw from Missouri River alluvium, no impacts are expected.

Health Assessment:

The primary contaminant of concern at the site is arsenic. Additional contaminants found in lower levels at the site included 2,4-D; 2,4,5-T; 2,4,6-T; PCP; antimony; mercury; lead; selenium; thallium; benzo(a)pyrene; cadmium; and dichlorophenol. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential health effects associated with these contaminants.

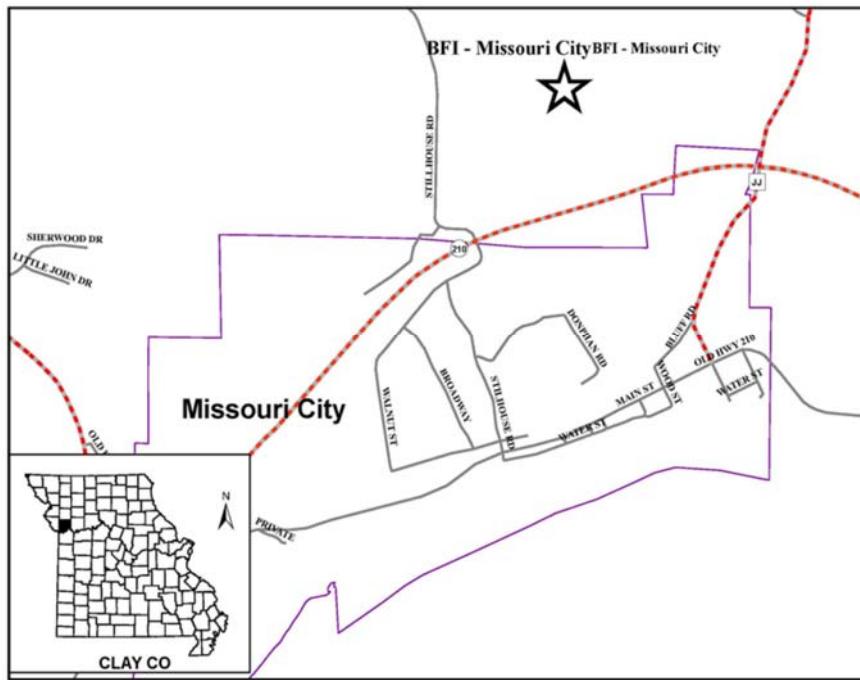
No nearby alluvial wells have been impacted by the Armour Road site and as long as the institutional controls are in place and active, there should be no impact to existing public water wells .

A Restrictive Covenant was placed on the property in 2005 that protects people from the remaining residual subsurface soil contamination. The site will continue to be monitored until the current remediation process is completed.

Based on the available information, this site does not appear to pose a significant health risk to the public at this time. If subsurface soils were to be disturbed, exposure to contaminated soils may occur. Groundwater is still being assessed. If site impacted groundwater were to infiltrate drinking water, adverse health effects may occur.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

BFI - Missouri City Landfill



Site Name: BFI - Missouri City Landfill, LLC

Classification: Class 2

Date of Registry Placement: January 1, 1984

Site Address: 8501 Stillhouse Road, Liberty, Clay County, Mo.

Present Property Owner: Missouri City Landfill, LLC, and Browning Ferris Industries (BFI) Waste Systems of North America, Inc., and Operated by BFI Waste Systems of North America (BFINA), LLC.

Lead Agency: Missouri Department of Natural Resources

Waste Type: Herbicide wastes, pesticide wastes, chrome sludge, paint thinners and strippers, and other industrial wastes

Quantity: Approximately 160 million pounds of industrial wastes were deposited by various businesses in the hazardous waste landfill cells.

Site Description: Located on a bluff above the Missouri River, the facility consists of about 200 acres, of which the southern 90 acres were used for waste management activities. Lincoln Brothers Land Inc. began

operating a sanitary landfill on the facility property in August 1972. BFI Inc. leased the property in November 1972 and continued to operate the sanitary landfill. BFI changed its name to BFI of Kansas City Inc. on December 29, 1972, and later became BFI Waste Systems of North America LLC (BFINA). The sanitary landfill accepted municipal wastes and certain industrial wastes, such as petroleum refining sludge, until 1974.

BFINA began constructing additional landfill cells and waste processing units to dispose of bulk liquid sludge in 1974. At least 160 million pounds of industrial wastes were disposed in the hazardous waste landfill cells, including phenoxyacetic acid herbicide wastes, organophosphate pesticide wastes, chrome sludge, paint thinners and strippers, and other industrial sludges. The hazardous waste management processing units included a chemical processing center, a chemical landfill, two LiqWaCon™ gelatin basins, three sludge drying beds, seven bulk sludge disposal trenches, a wastewater treatment pond, and a stormwater retention pond.

BFI - Missouri City discontinued waste disposal operations September 1983 and developed a closure plan for the landfill that was approved by EPA December 1984. BFINA closed each hazardous waste management unit separately, and installed a

multicomponent final cap over all the waste management units, addressing the entire area as one unit, collectively called the closed landfill. A fence and locked gate control access to the facility property. The property is located in rural Clay County. Several residences are located within one-half mile of the facility property boundaries.

Environmental Problems and Areas of Concern:

BFI Waste Systems investigated groundwater contamination related to releases from the landfill cells, and contaminated groundwater continues to be monitored, evaluated, and managed by the facility under the Missouri Hazardous Waste Management Facility Part I Permit issued by the Department August 14, 2017. Investigations documented impacts to the intermittent stream on the permitted property, including volatile organic solvents and hydrocarbons.

Remedial Actions:

Based on results of site investigations, BFI installed a leachate collection system and french drain to prevent off-property runoff and contaminant migration. During closure activities, BFI installed a passive gas collection system for the sanitary landfill and the two gelatin basins. An active gas extraction system became operational April 1988. After one month of operation of the gas system, methane was no longer detected in the gas monitoring probes. The gas collection system currently is inactive but remains capable of operation in the event sufficient methane gas is generated in the future to warrant further collection.

In 1996, BFI added an interceptor trench and collection sump to collect leachate where groundwater contamination was surfacing at outcrops along a ravine southeast of the landfill areas and downgradient of the groundwater interceptor trench. In 1997, BFI addressed cap maintenance on the New Gelatin Basin and reshaped erosion letdown areas on the east side of the landfill.

In 2010, BFI discovered a release containing volatile organic solvents and hydrocarbons in the intermittent stream on the permitted property. BFI conducted emergency response to reduce or eliminate any further impacts to surface water, conducted further

investigations, and evaluated alternatives to address the release. BFI conducted interim stabilization measures including: a stream bank interceptor trench completed in 2013 to prevent migration of contaminants to the intermittent stream; measures in 2014 to prevent rainwater from infiltrating behind the concrete plug on top of the stream bank interceptor trench; and in 2015-16 excavation of the impacted stream bed material and construction of a collector system to mitigate the potential for future impacts to the stream bed and associated surface water.

On August 14, 2017, the Department issued the final Missouri Hazardous Waste Management Facility Part I Permit for the BFI - Missouri City Landfill, which included provisions to construct and operate an on-property contaminated groundwater/leachate treatment plant. This will replace the current practice of pumping the hazardous remediation waste collected from the stream bank interceptor trench to the existing on-site storage tanks followed by off-property transport for proper disposal. The treatment plant is scheduled to be operational late 2018. BFI will send treated groundwater/leachate to be discharged in accordance with a Missouri State Operating Permit.

On June 28, 2018, the Department approved a plan for collecting water and air samples during start-up of the water treatment plant. Water treated during the start-up will be contained in the on-site 250,000-gallon effluent storage tanks prior to being discharged per the Missouri State Operating Permit issued by the Department's Water Protection Program.

General Geologic and Hydrologic Setting:

The soil, which averages 15 to 20 feet in thickness, is composed of moderately- to highly-permeable loess. Contaminants that leaked into the permeable soil have been shown to resurface downslope on the top of bedrock cropping out in surface drainage features. Surface water flow in tributaries has the potential to subsequently transport the contaminants onto the Missouri River alluvium, recharging that important aquifer. Contaminants also potentially could discharge directly into the Missouri River, though there has never been any evidence of such discharge.

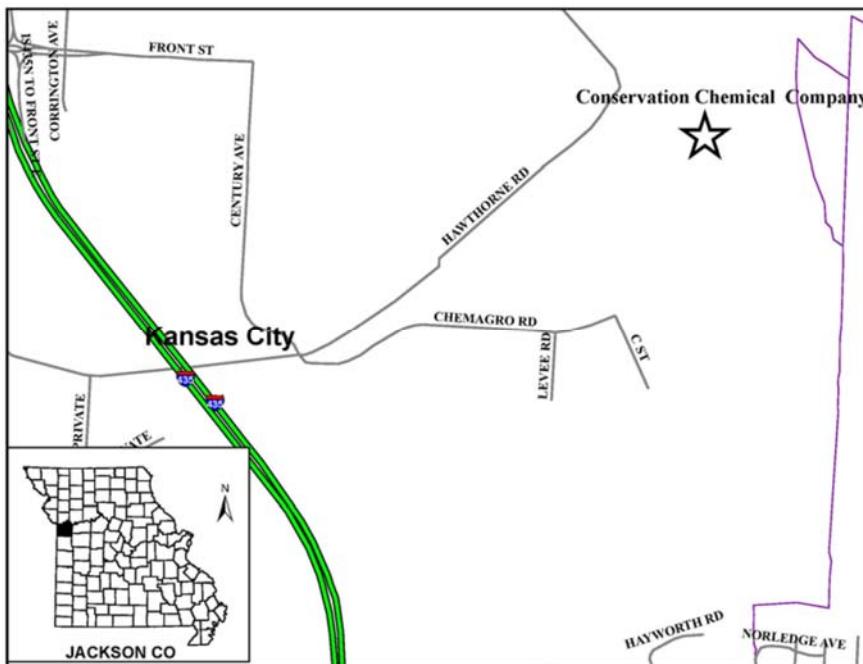
The bedrock beneath the facility consists of the Winterset Limestone and the Bethany Falls Limestone. A 5- to 7-foot sequence of shale is present between the limestone units. Several thin shale and limestone units are present beneath the Bethany Falls Limestone. Sandstone of the Pleasanton Group underlies these shales and limestone. All of the bedrock units, particularly the limestone, exhibit fracture permeability.

Public Drinking Water Advisory:

Missouri City purchases public drinking water from a public water supply district and does not draw water from the shallow alluvial aquifer over which it lies. The nearest active public water wells belong to the Tri-County Water Authority and are located approximately 2.5 miles southeast of the site along the southern bank of the Missouri River, while the City of Excelsior Springs uses a well field approximately 4 miles east of the site. Although these wells draw from the Missouri River

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Conservation Chemical Company



Site Name: Conservation Chemical Company

an industrial area, about 1.75 miles east of Interstate 435 along Levee Road in Kansas City, Mo.

Classification: Class 2

CCC began operating at the site in 1960. CCC disposed industrial wastes at the site from 1962 to 1980. In 1975, the Missouri Department of Natural Resources investigated the operation and ordered it closed and cleaned up. CCC closed the site in 1979. CCC conducted and completed post-closure activities in 1980, which included capping the six lagoons and grading and vegetating the remaining portion of the site. CCC also fenced the entire property to restrict access.

Date of Registry Placement: January 9, 1984

Environmental Problems and Areas of Concern:

Site Address: 8900 Front Street, Kansas City, Jackson County, Mo.

CCC stored wastes at the site, burying the wastes at least eight feet deep in six unlined lagoons.

Present Property Owner: Conservation Chemical Company (The company was administratively dissolved on Aug. 28, 2000, and the last company president listed prior to the company's dissolution died in April 2001.)

EPA conducted site investigations from 1979 through 1984. In 1984, the group of responsible parties, known as the Front Street Remedial Action Corporation (FSRAC) and included CCC, conducted a remedial investigation, which indicated contaminants were entering the groundwater and migrating off site. Phenols, heavy metals, and organic compounds were the major contaminants detected in the groundwater.

Lead Agency: U.S. Environmental Protection Agency (EPA)

Waste Type: Organic compounds, solvents, acids, caustics, metal hydroxides, cyanide compounds, pesticides, herbicides, waste oils, arsenic, and elemental phosphorus

Quantity: Estimated 93,000 cubic yards of material buried on site

Site Description: The Conservation Chemical Company (CCC) site covers about six acres and is situated in the flood plain at the confluence of the Missouri and Blue rivers on the river side of the levee. It is located in

Groundwater depth varies from about 5 to 13 feet. During the wetter parts of the year, groundwater comes into direct contact with the wastes. Since some of the wastes were hazardous and explosive in nature, CCC and EPA solidified the lagoons with fly ash rather than dewater and excavate during post-closure activities.

Remedial Actions:

The Focused Feasibility Study, completed May 1985, evaluated remedial alternatives for the Conservation Chemical Company site. EPA selected a remedial action that consisted of building a concrete wall around the site with interior pumping and treating of the groundwater.

In 1986, CCC conducted additional investigations that revealed the depth to bedrock was about 160 feet, making the construction of the concrete wall more difficult. In the same year, Superfund was amended and regulatory requirements changed. In light of these changes, EPA reassessed potential remedies.

In September 1987, the EPA signed the Record of Decision. The selected remedy consisted of: (1) surface cleanup, including demolition and disposal of existing buildings, tanks and debris; (2) installation of a two-layer protective surface cap over the existing fill, consisting of stable loess and topsoil; (3) installation of an extraction well system to achieve an inward groundwater gradient, to be measured by piezometer pairs along the perimeter of the site; (4) installation of a groundwater treatment system; and (5) off-site groundwater quality and water level monitoring to assess changes in the groundwater quality around the site.

In April 1988, the EPA and FSRAC signed the consent decree. The FSRAC performed the remedial action construction in three phases. FSRAC completed Phase I in August 1989 and it included: (1) surface cleanup and regrading the site's surface; (2) placement of a two-layer protective surface cap; and (3) placement of rip-rap and installation of a 6-foot-high metal perimeter fence. In April 1990, FSRAC completed Phase II and it included the installation of the following wells: (1) four pairs and redevelopment of two pairs of monitoring wells; (2) four pairs of piezometers;

and (3) two on-site extraction wells. In April 1990, FSRAC also completed construction of the Phase III on-site groundwater treatment plant.

The consent decree requires annual meetings between EPA, the Department, and FSRAC to review the status of remedial activities. In addition, the consent decree specifies that the defendants shall submit the following reports: (1) State Operating Permit Reports; (2) Off-site Groundwater Monitoring Reports; (3) Metals Removal Reports; and (4) Groundwater Level Monitoring Reports.

In April 1990, FSRAC started the groundwater extraction well system, monitoring well network, and groundwater treatment plant. FSRAC is required to operate the extraction system and groundwater treatment plant for at least 30 years. Discussions to extend or terminate these activities will be part of an upcoming meeting in November 2018.

Originally, the treatment process involved two metal precipitation systems: lime and sulfide. In March 1999, FSRAC took the sulfide system offline due to problems. The modified treatment system continued to remediate the plant's effluent to meet state operating permit criteria. In January 2003, EPA signed the Explanation of Significant Differences for the permanent removal of the sulfide system, thus creating a modified treatment system, with Department concurrence.

As required by the consent decree, FSRAC inspects the surface cap on a regular interval. Any erosion must be repaired immediately and vegetative cover added if needed. The grass must be mowed during the growing season. No excavation into the surface cap will be allowed without prior written approval. Wastes generated by the treatment plant must be disposed properly. FSRAC must prepare an annual operating summary at the end of each calendar year and present to the EPA and the Department in a fall annual meeting.

In June 1996, FSRAC presented a proposal to EPA and the Department to allow them to explore alternative approaches to remediate the site. The EPA and the Department gave approval to explore alternative approaches while maintaining the current remedy. Based on the project's conclusions, FSRAC did not propose an alternative remedial approach to the site's remedy.

In February 2000, EPA completed the first five-year review to ensure the chosen remedy was functioning as designed. EPA determined all response actions complied with the requirements of the record of decision and consent decree, and were protective of human health by eliminating site-related risks associated with direct contact to the on-site wastes.

Sampling and monitoring of the extraction and monitoring wells and piezometers must be done regularly. The groundwater extraction well system achieved the inward gradient requirements until August 2000. Multiple conditions, including the Missouri River's low water flow, led to problems maintaining the inward gradient. EPA requested the defendants conduct a study of the groundwater plume. In October 2004, FSRAC completed the study and documented that the system had maintained hydraulic control even with the failure of an inward gradient.

In September 2007, EPA completed the second five-year review. EPA determined the remedy was functioning as intended and was meeting the performance criteria of the consent decree. However, the review identified four issues that needed further investigation before the next five-year review.

Due to deteriorating conditions in the south extraction well, FSRAC recommended replacing the south extraction well October 2007. In May 2008, the EPA and the Department granted approval for replacing the south well, and FSRAC closed the old well and they completed the new well on July 15, 2008.

Over a number of years, the metals concentrations decreased within the influent stream. EPA and the Department approved a work plan to allow FSRAC to investigate, as an optimization test, operating the groundwater treatment system without the metals precipitation system in 2009. FSRAC conducted the optimization test. In 2010, the EPA approved the system operating without the metal precipitation system.

On September 27, 2012, EPA completed the third five-year review. The review identified five issues that could affect the long-term protectiveness of the remedy, so the protectiveness determination was deferred.

FSRAC conducted additional work related to the five issues. EPA completed the "Addendum to Conservation Chemical Company Third Five-Year Review Report" September 24, 2015 related to the work done regarding the five issues. EPA's Addendum determined the site remedy is "currently protective of human health and the environment because all threats have been addressed."

On September 21, 2017, EPA completed the fourth Five-Year Review. The fourth Five-Year Review identified four issues, two of which carried over from the third Five-Year Review. The fourth Five-Year Review determined "the remedy currently protects human health and the environment because the landfill cover prevents exposure to waste materials and the extraction and treatment system limits off-site, lateral migration of contaminants."

General Geologic and Hydrologic Setting:

On-site soil is greater than 100 feet thick and is composed of alluvial sand, silt, and clay. Typically, the grain size of these materials increases with depth. Bedrock is composed principally of interbedded shale and limestone, but is relatively unimportant in considering groundwater contamination potential because of its low permeability and great depth.

The alluvial aquifer is an excellent source of water. The elevation of the water table fluctuates, depending on the water level of the Missouri River. The direction of normal groundwater flow beneath the site is anticipated to be northeast toward the river. During flood stage, however, groundwater is recharged by the river.

The principal concern at this site is the potential for lateral migration of hazardous wastes off site. Subsurface migration of contaminants through alluvial materials to the Missouri River is occurring.

Public Drinking Water Advisory:

No public water sources are located in the immediate vicinity of the Conservation Chemical Company site. The city of Independence uses multiple wells that draw from the Missouri River alluvial aquifer, but these are approximately 4 miles downstream. Although there is documented migration of contaminated groundwater towards the

Missouri River from the site, no impacts are expected.

Health Assessment:

The following are the major contaminants of concern: benzene; cyanide; vinyl chloride; methylene chloride; 1,1,1-trichloroethane; trichloroethene; 1,2-dichloroethane; chloroform; lindane; phenol; mercury; chromium; lead; arsenic; cadmium; and nickel. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Based on available information, a potential health risk exists due to the potential of the migration of contaminants to the Missouri River and the open and unguarded accessibility via the levee. However, no direct evidence of human exposure exists from this site.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

HCI Chemtech - Birmingham Road



Site Name: HCI Chemtech-Birmingham Road

Classification: Class 2

Date of Registry Placement: March 5, 1999

Site Address: 6301 Northeast Birmingham Road, North Kansas City, Clay County, Mo.

Present Property Owner: Brenntag, Inc.
(Portion on Cerner Corporation property)

Lead Agency: Missouri Department of Natural Resources

Waste Type: Volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs)

Quantity: Not determined

Site Description: The HCI Chemtech-Birmingham Road site is a bulk chemical storage and distribution facility that has been in operation since 1968 under various companies. The facility encompasses 11 acres situated along the northern bank of the Missouri River. Residences are located about 1,000 feet north of the site. The site is fenced with a security restrictive gate. On-site structures include an office, warehouse, maintenance buildings, boiler heating

facilities, laboratory, and tank farms containing aboveground storage tanks. Only nine of the aboveground storage tanks are active. Current storage and handling activities are restricted to caustics, asphalt, and diesel emission fluid due to the transfer of some operations to the HCI Chemtech-Stillwell Street facility. An eastern portion of the HCI Chemtech-Birmingham Road site is on property currently owned and operated by the Cerner Corporation. The Cerner property consists of the former chemical storage warehouse, a small office building, and a vegetated tract of land.

During previous site operations, as many as 66 aboveground storage tanks have been used at the site. Until 1995, when the floors were paved with concrete, 46 of those tanks were located in containment areas with earthen floors. Trucks, barges, and railcars delivered bulk chemicals to the facility. The chemicals were stored in aboveground storage tanks.

Spills are the probable source of on-site contamination of soils and groundwater with VOCs, SVOCs, and herbicides. The HCI Chemtech-Birmingham Road facility has a history of spills and releases of hazardous materials dating back to the 1970s. The most serious of these releases occurred September

10, 1995, when at least 13,000 pounds of rayon grade sodium hydroxide was released on site. The company diluted this material with water and released effluent with a pH of 12.8 into the Missouri River.

Environmental Problems and Areas of Concern:

Site investigations performed by various property owners over time show that volatile organic compounds have been detected at concentrations above health-based screening levels in soil and groundwater. The pH of shallow groundwater has been documented at values ranging from 6.85 to 11.9. The site is located in a 20-year flood plain. A significant potential exists for site-related contaminants to be released to the Missouri River during a flood event. Erosion and dissolution of waste during flood conditions could allow for direct transport of contamination or could result in the generation of leachate. Significant releases of contaminants from the facility entered the Missouri River in 1994 and 1995. Groundwater to surface water discharge is also likely. Groundwater generates seepage along the river bluff, and this seepage discharges into the Missouri River.

In 1992, an explosion on site killed three employees welding near a tank emitting anhydrous ethanol vapors.

The Department issued a notice of violation to HCI Chemtech after an inspection December 10, 1993. Citations included failure to have secondary containment and maintaining a satellite area of unlabeled drums near the hazardous waste storage tank. The Department conducted a joint hazardous waste and air pollution compliance evaluation August 2, 1995, and cited the company for 17 violations of the Missouri Hazardous Waste Management Law. The violations indicated that the company was not properly handling hazardous waste nor maintaining adequate secondary containment for hazardous materials.

On December 13, 2012, the Department's Kansas City Regional Office, which reviews the facility's wastewater discharge monitoring reports, issued Brenntag a letter of warning. The letter cited discharge monitoring reports in which pH effluent limitations had been exceeded for February, March, April, and

September 2012. In 2013, the facility addressed the issue by changing the pumps in the boiler house to eliminate the use of cooling water and active discharge at the outfall in question.

Remedial Actions:

Following a release of sodium hydroxide September 1995, HCI Chemtech was indicted for criminal violations of the Clean Water Act, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and Resource Conservation and Recovery Act (RCRA). HCI Chemtech pled guilty to one violation of the Clean Water Act and was placed on probation. As a special condition of this probation, HCI Chemtech was required to adopt corporate and compliance monitoring programs for each of its facilities in Missouri. HCI Chemtech, the U.S. Attorney's Office, EPA, and the Department entered into a compliance agreement. The agreement became effective November 7, 1997, and specified that HCI Chemtech investigate and characterize its sites.

In March 1998, the Department completed a CERCLA preliminary assessment, which concluded that further CERCLA action was warranted. Pursuant to the 1997 compliance agreement, HCI Chemtech conducted remedial investigation work to help determine the horizontal and vertical extent of contamination in the soils and the groundwater. The consultants for HCI Chemtech conducted sampling in 2000, and conducted quarterly groundwater monitoring for two years. In fall 2000, Brenntag Inc. purchased HCI Chemtech. The compliance agreement expired, also in fall 2000, when the HCI Chemtech's probation ended.

In fall 2006, EPA ceased its negotiations with Brenntag for continued investigation leading to site cleanup and transferred the site to the Department. On September 2, 2008, Brenntag, the Missouri Attorney General's Office, and the Department entered into an Abatement Order on Consent for Remedial Investigation/Feasibility Study of the site. The goals of the study were to determine the nature and extent of contamination on site, and evaluate alternatives for remedial actions, if any. Because the previous property owner conducted some remedial investigation work, Brenntag's investigation is referred to as a

Phase II remedial investigation.

From June 2000-2009, the groundwater monitoring network consisted of up to eight shallow monitoring wells, which Brenntag sampled for volatile organic compounds on a quarterly basis. The highest levels of VOCs were in MW-2, MW-3, MW-7, and MW-8 in the central portion of the site. As part of Brenntag's Phase II remedial investigation in 2009, the monitoring wells were replaced and additional wells installed, bringing the network to a total of fourteen wells, including two well couplets. The expanded monitoring well network better captures the lateral and vertical extents of the contaminant plume. Quarterly monitoring continued until first quarter 2012, after which Brenntag proposed conducting semi-annual monitoring due to the consistency of constituent concentrations in groundwater.

On April 3, 2012, the Department approved Brenntag's Phase II Remedial Investigation and associated Human Health Risk Assessment and Ecological Risk Assessment reports, revised March 9, 2012. These are discussed below and also in the health assessment summary section. The investigations involved the sampling and analysis of surface and subsurface soil, groundwater, sediment, surface water, and seep samples.

The 2012 remedial investigation confirmed four soil source areas in the central portion of the site: aboveground storage tank area, former chemical storage warehouse, northern truck loading area, and rail loading rack. Groundwater characterization defined the extent of petroleum and chlorinated VOCs in groundwater to the north, east, and west. It was apparent that dissolved phase VOCs at concentrations above screening levels were entering the Missouri River along the southern boundary of the site. Herbicides were not found at concentrations above screening levels. Therefore, the Department determined that no additional investigation or remediation is necessary for herbicides at the site.

The results of the ecological risk assessment indicated that no unacceptable risks to any current exposure scenarios or hypothetical future scenarios exist. However, the ecological risk assessment assumptions may need to be revisited in the event that the

asphalt is removed from the site.

The remedial investigation recommended a soil vapor extraction pilot test to evaluate the use of soil vapor extraction for interim soil remediation of the soil source areas to mitigate further leaching to groundwater. In May 2013, Brenntag conducted the soil vapor extraction/air sparge pilot test with Department approval. The pilot test data confirmed the feasibility of soil vapor extraction/air sparge as a remedial option to address site contaminants. Brenntag then utilized the findings of the Phase II remedial investigation and risk assessments to evaluate potential remedial action alternatives for the site; Brenntag documented this work in a feasibility study report. In April 2017, the Department approved the revised feasibility study report, dated February 8, 2017. The Department will propose one of the remedial alternatives for the site in an upcoming proposed plan.

In May 2013, the semi-annual groundwater monitoring program started and continues presently. The Department completed the Fiscal Year 2018 annual inspection on April 26, 2018, and noted the tanks and grounds are well maintained.

General Geologic and Hydrologic Setting:

The HCI Chemtech-Birmingham Road site is located within the 20-year flood plain just to the north of the Missouri River. The topography is generally level.

The site is underlain by about 120 feet of moderately- to highly-permeable alluvium, composed of interbedded sand, gravel, and clay. The alluvium is, in turn, underlain by the Pennsylvanian-age Kansas City Group, which is made up of interbedded shales and limestones with low to moderate permeability.

The alluvial aquifer is recharged through surface water infiltration, as well as through discharge from surrounding bedrock. In general, the groundwater within the alluvium beneath the site flows toward the Missouri River. Hydraulic gradient and actual groundwater flow direction are dependent upon fluctuating river level.

Public Drinking Water Advisory:

No public water sources are located in the immediate vicinity of the HCI Chemtech – Birmingham Road site. The cities of Independence and Liberty use the Missouri River alluvial aquifer as a primary source of public drinking water, but these wells are located approx. 6 miles east of the site. The nearest surface water intake is approximately 43 river-miles downstream of the site. No impacts to active water sources are expected.

Health Assessment:

The chemicals of concern at this site include a total of 26 different VOCs including but not limited to tetrachloroethylene, trichloroethylene, 1,2-dichlorobenzene, benzene, 1,4-dichlorobenzene, toluene, ethyl benzene, and xylene. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

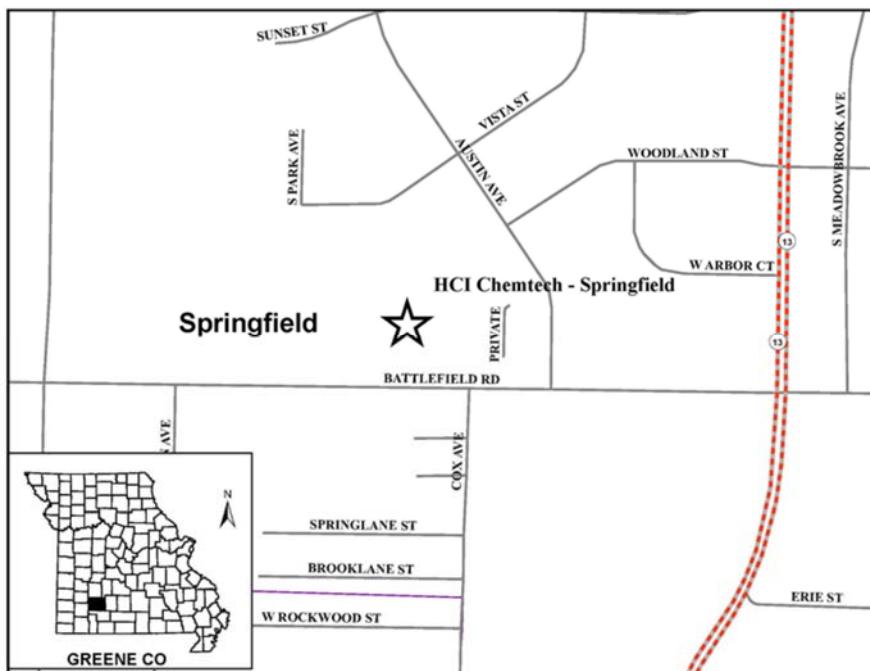
The April 2012 approved Human Health Risk Assessment determined there were no unacceptable risks to any of the current exposure scenarios (i.e., current site worker or current site visitor). Groundwater monitoring continues as volatile organic compounds still are being detected above preliminary remediation goals.

The Department identified four private drinking water supply wells within a four-mile radius of this site. However, these private wells are considered too far removed from the site to be impacted; therefore, no testing has been done.

Based on available information, this site does not appear to pose a significant health risk to the public at this time. However, if site conditions were to change such that exposures to contaminated soils or groundwater were to occur, adverse health effects may occur.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

HCI Chemtech-Springfield



Site Name: HCI Chemtech-Springfield

Classification: Class 2

Date of Registry Placement: March 26, 1999

Site Address: 2235 W. Battlefield Road,
Springfield, Greene County, Mo.

Present Property Owner: Brenntag, Inc.

Lead Agency: Missouri Department of
Natural Resources

Waste Type: Includes but is not limited to:
Volatile and semi-volatile organic compounds
including benzene, ethylbenzene, toluene,
total xylenes, naphthalene, cis-1,2-
dichloroethylene, 1,1-dichloroethane, 1,2-
dichloroethane, trichloroethylene (TCE),
tetrachloroethylene (PCE), and vinyl chloride

Quantity: Not determined

Site Description: A chemical distribution
facility has operated at the site since 1975.
The site encompasses 3.75 acres in a
commercial and light industrial area.

Residences are located about 800 feet up
gradient from the site. On-site structures
include an office, warehouse, bag house
(formerly a drum rinsing building), a drum

storage canopy, and a storage shed. In 2012,
Brenntag removed an inactive tank farm that
contained a number of aboveground storage
tanks within a concrete floored containment
area.

Spills and drum rinsing are the probable
sources of on-site contamination of soils and
groundwater. Previous operations at the site
included chemical storage, chemical blending,
unloading of chemicals from railcars, drum
recycling/reconditioning, and paint spraying.
Chemicals handled and stored at the facility
included caustics, aromatic solvents, acids,
ketones, alcohols, glycols, petroleum
hydrocarbons, and chlorinated solvents. The
facility never manufactured chemicals.
Currently, the facility only stores and
distributes pre-packaged chemicals.
According to a 1988 report prepared by Pilko
and Associates, two spills were documented
at the site. One spill consisted of chlorinated
solvents during the mid-1970s, near the
northern property boundary. The other spill
occurred June 1986 and involved
approximately 500 gallons of solvent (230
gallons was recovered by Chemtech
Industries, Inc.) in the former tank truck
loading area.

Environmental Problems and Areas of Concern:

Laboratory analysis documented volatile organic compounds at concentrations above health-based screening levels in shallow groundwater, soil, soil gas, and subslab soil gas beneath the warehouse at the site. Shallow groundwater volatile organic compound contamination has migrated off site onto property to the north and west.

Remedial Actions:

Following a release of sodium hydroxide at its Birmingham Road facility in Kansas City September 1995, the owner of the site, HCl Chemtech, was indicted for criminal violations of the Clean Water Act, Comprehensive Environmental Response, Compensation, and Liability Act and Resource Conservation and Recovery Act. HCl Chemtech pled guilty to one violation of the Clean Water Act and was placed on probation. As a special condition of this probation, HCl Chemtech was required to adopt corporate and compliance monitoring programs for each of its facilities in Missouri. HCl Chemtech, the U.S. Attorney's Office, EPA, and the Department entered into a compliance agreement. The agreement became effective November 7, 1997 and specified that HCl Chemtech investigate and characterize its sites.

Results from monitoring wells installed July 2000 showed contamination in the Springfield Plateau Aquifer. Brenntag, Inc. purchased HCl Chemtech in fall 2000. The compliance agreement expired, also in fall 2000, when HCl Chemtech's probation ended. The Department completed an expanded site inspection in March 2001. Brenntag signed an Administrative Order on Consent with EPA fall 2001 to perform a remedial investigation and to continue operating the soil vapor extraction system as an interim remedial action.

The soil vapor extraction system continues to remove and treat contaminated groundwater and associated soil vapors. Treated water is discharged to the city of Springfield's wastewater treatment system by permit. Ongoing groundwater monitoring results show the interim remedial action is improving groundwater quality and maintaining hydraulic control of contaminants on the site property. In addition to the soil vapor extraction system, in 2009, Brenntag installed a subslab vapor

extraction system to remove vapors from beneath the northern portion of the warehouse building floor. This system operates in a continuous mode. Brenntag continues to monitor the efficiency of the system by collecting routine samples.

In April 2016, Brenntag notified the Department of development of the vacant property north of the site, where shallow groundwater contamination existed. The owner of the property requested that all six monitoring wells be removed. The Department requested that in-situ chemical oxidation be conducted on the property prior to development. Brenntag selected in-situ chemical oxidation to eliminate and reduce the existing groundwater contaminants. The Department received and approved a work plan for the in-situ chemical oxidation procedure and approved the removal of the monitoring wells contingent upon their replacement after property development was complete. Brenntag completed the in-situ chemical oxidation work and monitoring well abandonment in August 2016.

The Department finalized the record of decision for the site on April 28, 2017. The selected remedy involves excavation and disposal of contaminated soil followed with additional in-situ chemical oxidation. The Department is negotiating a legal agreement with Brenntag for commencement of remedial work. The Department completed the Fiscal Year 2018 annual inspection on June 26, 2018, and the inspection noted nothing of significance.

General Geologic and Hydrologic Setting:

The HCl Chemtech-Springfield site is located within the Springfield Plateau portion of the Ozark Plateau physiographic province. It is situated on a highland between South Creek and an unnamed tributary of Wilson Creek.

The site is situated in a karst area. The site is underlain by 0.5 to 2.5 feet of moderately- to highly-permeable fill composed of gravel, sand, silt, and clay. The fill is underlain by 15 to 25 feet of tight silty, sandy clay residuum with thin lenses of chert. The residuum is characterized as having low hydraulic conductivity. In turn, the residuum is underlain by Mississippian-age limestone. The highly-weathered limestone is very fractured and permeable in its upper strata, and evidence of

Karst features abound. Unconsolidated and very fine-grain sediment (predominantly clay and silt) have filled the solution voids encountered at the weathered limestone subcrop. Additional karst features in the immediate vicinity include six known sinkholes within one mile of the site as well as known springs and 24 known caves within a four-mile radius.

The Mississippian-age limestones beneath the site compose an unconfined aquifer known as the Springfield Plateau Aquifer. The aquifer is about 300 feet thick in this area. Recharge of the Springfield Plateau Aquifer occurs through infiltration of precipitation. Shallow groundwater within the aquifer moves to the northwest relative to the contaminant source areas. The Northview Formation, which is about 20 feet thick in the vicinity of the site, is present beneath the Springfield Plateau Aquifer. The Northview Formation is considered to be an aquitard, separating the overlying Springfield Plateau Aquifer from the underlying Ozark Aquifer. Typically, the Northview Formation is relatively impermeable; however, locally, the Northview may be breached by faults or boreholes, resulting in some potential for vertical contaminant transport into the deeper Ozark Aquifer. Several on- and off-site monitoring wells screened in the Ozark Aquifer indicate that no contamination from the site has reached the lower aquifer.

Public Drinking Water Advisory:

Contamination from the HCI Chemtech – Springfield site has impacted the upper Springfield Plateau aquifer, which is characterized by karst conditions such as springs, sinkholes, and rapid infiltration of surface water into the aquifer. The city of Springfield and other public water systems that use groundwater near this site use wells that draw from the deeper Ozark aquifer. Vertical migration of groundwater between the upper and lower aquifers is minimal in this area due to the presence of a layer of low-permeability shale; however, fractures in bedrock or boreholes that penetrate both aquifers may locally allow mixing between the two. With continued proper management of the site, no impacts to active public water sources are expected.

Health Assessment:

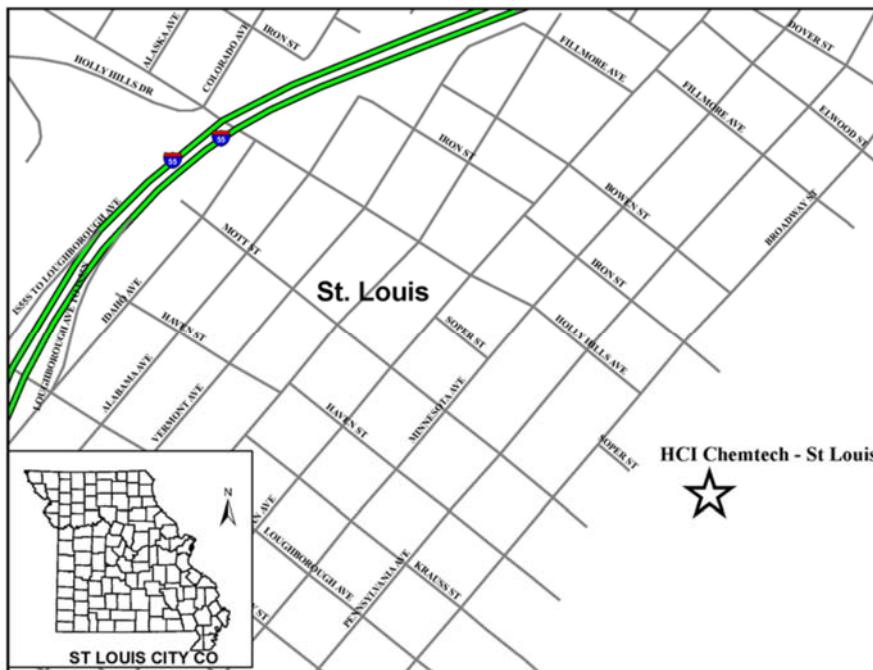
Contaminants of concern at this site include but are not limited to: volatile and semi-volatile organic compounds including benzene, ethylbenzene, toluene, total xylenes, naphthalene, cis-1,2-dichloroethylene, 1,1-dichloroethane, 1,2-dichloroethane, TCE, PCE, and vinyl chloride.

Soil, groundwater, subslab soil gas, and soil gas are contaminated with various volatile organic compounds. Off-site migration of shallow groundwater volatile organic compound contamination has been documented. In particular, groundwater contaminants found above the public drinking water standards include, but are not limited to: 1,1-DCA, cis-1,2-dichloroethylene, TCE, PCE, toluene, benzene, vinyl chloride, and xylene. A Human Health Risk Assessment, approved in 2011, documented risk to human health if site contamination is not addressed adequately. A previous investigation by the Missouri Department of Health and Senior Services did not identify any private wells that were in use around the facility.

Due to detections of contaminants in soil, soil gas, subslab soil gas, groundwater in the close proximity of homes, and the off-site migration of volatile organic compound contaminated groundwater, a health risk exists at this site.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

HCI Chemtech-St. Louis



Site Name: HCI Chemtech - St. Louis

Classification: Class 2

Date of Registry Placement: December 28, 1998

Site Address: 139 E. Soper St., St. Louis, Mo.

Present Property Owner: Brenntag, Inc.

Lead Agency: Missouri Department of Natural Resources

Waste Type: Volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals

Quantity: Not determined

Site Description: The HCI Chemtech - St. Louis site is an active chemical formulation and distribution facility that has operated since 1967. Chemtech Industries Inc. began operating in 1979. In 1992, Holland Chemicals International purchased the property and began operating as HCI-Chemtech. Brenntag Mid-South, Inc. (Brenntag) purchased the property and began operating in December 2000. The site encompasses 15 acres in an industrial area. Residences are located about 1,000 feet west of the site. On-site structures

include an office, a warehouse, and tank farms containing 76 aboveground storage tanks. As many as 92 aboveground storage tanks have been used during past operations. Those tanks were located in containment areas with earthen floors until 1992, when most of the storage areas were paved with concrete.

Trucks, barges and railcars deliver bulk chemicals, which are stored in the aboveground storage tanks. Chemicals may be mixed, repackaged prior to sale, or sold in bulk. Wastewater generated from drum rinsing is neutralized and discharged to the sewer system under a permit from the local sewer district.

The HCI Chemtech - St. Louis site, before Brenntag purchased the property, had a history of spills and releases of hazardous materials that dates back to the 1980s. The spills and drum rinsing operation are the probable sources of on-site contamination of soils and groundwater.

Environmental Problems and Areas of Concern:

From 1991 to 2000, HCI-Chemtech conducted investigations of soil and groundwater. Sample results revealed VOCs, SVOCs, and metals present at concentrations above

health-based screening levels in soils and groundwater. Hazardous substances from the site could also be released to the Mississippi River during a flood event.

Brenntag has conducted groundwater monitoring and sampling on the joint Brenntag and the U.S. Coast Guard Old Base site since Brenntag purchased the site in 2000 to evaluate the nature and extent of site-related contaminants of concern. Total benzene, toluene, ethylene, and xylene and chlorinated VOCs originating in the central portion of the site have commingled and appear to be migrating toward the Mississippi River and onto the U.S. Coast Guard Old Base.

HCI Chemtech was indicted for criminal violations of the Clean Water Act, the Comprehensive Environmental Response, Compensation, and Liability Act, and the Resource Conservation and Recovery Act following a sodium hydroxide release September 1995, at its Birmingham Road facility in Kansas City. HCI Chemtech pled guilty to one violation of the Clean Water Act and was placed on probation. As a special condition of the probation, HCI Chemtech was required to adopt corporate and compliance monitoring programs for each of its facilities in Missouri. HCI Chemtech, the U.S. Attorney's Office, EPA, and the Department entered into a compliance agreement. The agreement became effective November 7, 1997, and specifies that HCI Chemtech shall investigate and characterize its sites.

Remedial Actions:

During Fiscal Year 1999, EPA and the Department reviewed and commented on plans and reports submitted by HCI Chemtech pursuant to the Compliance Agreement. During 2000, EPA and the Department approved HCI Chemtech's Remedial Investigation Work Plan that included the installation of additional monitoring wells and hydrogeological investigations.

In fall 2000, Brenntag Inc. purchased HCI Chemtech. The compliance agreement expired, also in fall 2000, when HCI Chemtech's probation for criminal violations at its Birmingham Road facility ended. No additional characterization or remedial action occurred; however, groundwater monitoring continued.

In 2003, EPA began negotiating orders for all of the Chemtech sites. On March 15, 2004, EPA finalized an Administrative Order on Consent, so Brenntag could complete an Engineering Evaluation/Cost Analysis for the site. The main objective of the Engineering Evaluation/Cost Analysis was to identify a removal action to remediate impacted soils and groundwater. In May 2004, Brenntag submitted a draft Engineering Evaluation/Cost Analysis Work Plan.

In February 2005, Brenntag submitted a revised draft Engineering Evaluation/Cost Analysis Report. In February 2006, EPA and the Department disapproved the draft Engineering Evaluation/Cost Analysis. In April 2006, the EPA and the Department met with Brenntag to discuss issues related to the Engineering Evaluation/Cost Analysis.

In 2007, EPA requested the Department assume the leadership of all four HCI Chemtech sites. The EPA and the Department closed out the Engineering Evaluation/Cost Analysis, so no work was completed under the authority of EPA's order. The Department and Brenntag signed an Abatement Order on Consent for the St. Louis site March 15, 2011. On July 16, 2012, the Department approved a work plan for the Phase 1 Remedial Investigation/Feasibility Study. Brenntag is conducting the Remedial Investigation/Feasibility Study for the St. Louis site. The Remedial Investigation Report should be complete by the end of December 2018.

In March 2016, as part of additional site-related work, the Department approved a vapor intrusion work plan. The vapor intrusion study consists of sampling multiple locations for indoor air and sub-slab vapor intrusion.

General Geologic and Hydrologic Setting:

The HCI Chemtech-St. Louis site is underlain by 18 to 35 feet of moderately- to highly-permeable fill material composed of sand, silt, slag, and rubble. The fill is underlain by 5 to 20 feet of moderately- to highly-permeable alluvial sediments composed of clayey silts and sands. The alluvial sediments, in turn, are underlain by the moderately-permeable, Mississippian-age St. Louis Limestone. The depth to bedrock beneath the site is about 40 feet, with depth increasing toward the Mississippi River.

Shallow groundwater beneath the site is recharged through infiltration of precipitation and through discharge from surrounding bedrock. The direction of groundwater flow is generally to the east toward the Mississippi River, with hydraulic gradient and actual groundwater flow direction dependent upon fluctuating river levels.

Since the site is located in a groundwater discharge setting, contaminants from the site may not impact the underlying bedrock. However, significant potential exists for site contaminants to discharge to the Mississippi River.

Public Drinking Water Advisory:

No active public water wells or surface intakes are located proximal to this site. The city of Chester, Ill., and the Menard Correction Center Department (Chester, Ill.) have surface water intakes approx. 63 river-miles downstream. No impacts are expected.

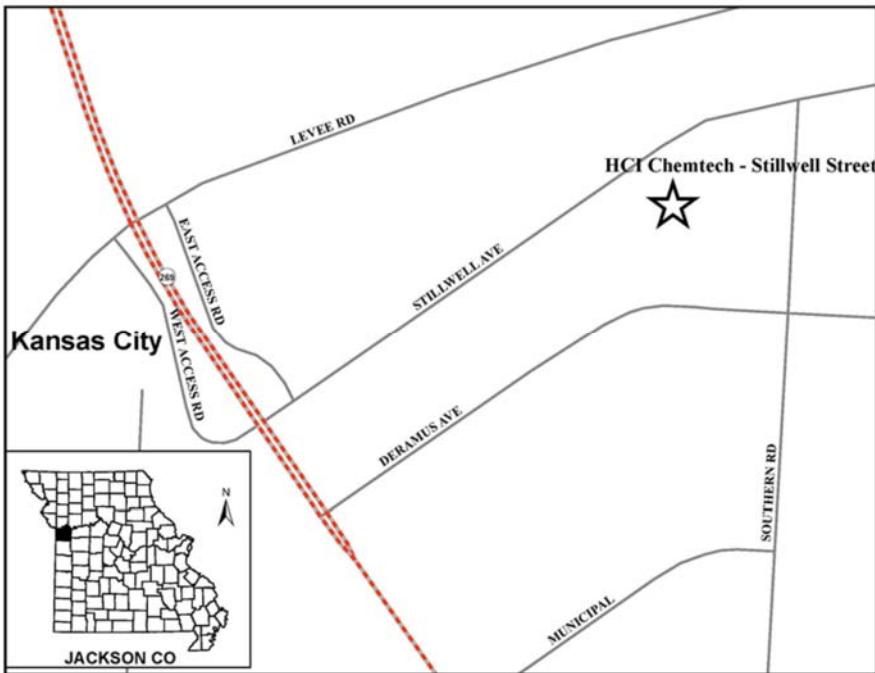
Health Assessment:

Toluene, arsenic, and several other polycyclic aromatic hydrocarbons [benzo(a)anthracene, benzo(k)fluoranthene, benzo(a)pyrene and indeno(1,2,3-cd)pyrene] have been detected in the soil at concentrations exceeding health-based screening levels. These chemicals and benzene, toluene, xylene, and chlorinated VOCs have also been detected in the groundwater under the site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Groundwater migration off site on to the U.S. Coast Guard property may pose a health risk to indoor workers. Risk associated with the groundwater-to-indoor-air pathway may exist. There is potential for hazardous waste substances to be released during flooding and/or rising groundwater levels. Based on available information, this site poses a potential health threat.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

HCI Chemtech-Stillwell Street



Site Name: HCI Chemtech - Stillwell Street

Classification: Class 2

Date of Registry Placement: August 21, 1999

Site Address: 5200 Stillwell Street, Kansas City, Jackson County, Mo.

Present Property Owner: Brenntag Mid-South, Inc.

Lead Agency: Missouri Department of Natural Resources

Waste Type: Volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs)

Quantity: Not determined

Site Description: A bulk chemical storage and distribution facility has operated at the site since 1981. The site occupies 6.5 acres along the southern bank of the Missouri River levee in a mixed commercial and industrial area. Residences are located approximately one-half mile from the site.

On-site structures include an office, warehouse, and tank farms that contained about 50 aboveground storage tanks.

Trucks and railcars delivery bulk chemicals, which are stored in aboveground storage tanks. Chemicals may be mixed, repackaged prior to sale, or sold in bulk. Releases and spills are the probable source of contamination of soils and groundwater.

Environmental Problems and Areas of Concern:

The site is in the Missouri River flood plain. In 1991, RMT, Inc. on behalf of Ashland Chemicals detected VOCs and SVOCs in groundwater at concentrations above health-based screening levels. In April 1992, RMT Inc. conducted a Phase II investigation, which concluded groundwater contaminants originating on the HCI Chemtech - Stillwell Street property were migrating off site to the north beneath the Riverfront Landfill. The groundwater plume has contracted to the center of the property near the source areas.

Remedial Actions:

In July 1997, a former owner and operator of the site, Union Oil Company of California Corporation, enrolled the Stillwell Street facility in the Department's Brownfields/Voluntary Cleanup Program to investigate and remediate on-site contamination that occurred during its occupancy.

Following a release of sodium hydroxide at its Birmingham Road facility in September 1995, HCI Chemtech, the site owner, was indicted for criminal violations of the Clean Water Act, the Comprehensive Environmental Response, Compensation, and Liability Act, and the Resource Conservation and Recovery Act. HCI Chemtech pled guilty to one violation of the Clean Water Act and was placed on probation. As a special condition of probation, HCI Chemtech was required to adopt corporate and compliance monitoring programs for each of its facilities in Missouri. HCI Chemtech, the U.S. Attorney's Office, EPA, and the Missouri Department of Natural Resources (the Department) entered into a compliance agreement. The agreement became effective November 7, 1997, and specifies that HCI Chemtech investigate and characterize its sites. Because such investigations are required of HCI Chemtech under an enforcement action, in accordance with Sections 260.565 through 260.575, RSMo, the site was no longer eligible for participation in Department's Brownfields/Voluntary Cleanup Program. Union Oil Company of California's participation in program was terminated February 18, 1999.

In June 2000, HCI Chemtech submitted a remedial investigation work plan. In fall 2000, Brenntag Mid-South, Inc. (Brenntag), purchased HCI Chemtech. Since 2001, Brenntag has performed groundwater monitoring at the site on a semi-annual schedule. The Department receives quarterly progress reports with the results of the groundwater monitoring. EPA and Brenntag entered into an Administrative Order on Consent for a remedial investigation and feasibility study to be conducted by Brenntag September 2005. The Administrative Order on Consent required Brenntag to determine the extent of the release of hazardous substances at or from the site, and to develop and evaluate options for remedial action. In August 2008, EPA approved the Remedial Investigation Report and the Human Health Risk Assessment.

On January 21, 2011, EPA approved the feasibility study. Pursuant to the completion of the Administrative Order on Consent, EPA issued the notice of completion of the Administrative Order on Consent March 16, 2011. On September 21, 2011, EPA transferred future management of the site to the Department.

On May 16, 2007, EPA approved a soil vapor extraction pilot test and a soil vapor extraction design report. The pilot test indicated that source area (soils) contaminated with volatile organic compounds could be addressed immediately and additional actions could be implemented if needed. Based upon the successes of the soil vapor extraction pilot test, Brenntag installed a full-scale soil vapor extraction system as an additional response action to treat soil in the source areas in 2008.

The soil vapor system operated for over eight years. Based on the historic removal rates found in the quarterly progress reports, the soil vapor extraction system successfully addressed the unsaturated volatile organic compound impacted soils. The estimated total VOCs mass removed since startup of the soil vapor extraction system through February 10, 2017, was approximately 3,087.6 pounds. Therefore, Brenntag recommended that the soil vapor extraction system be deactivated to begin a period of monitored natural attenuation to assess the performance of the remedial alternative. On February 24, 2017, the Department approved the shutdown of the soil vapor extraction system.

The Department has prepared a proposed plan for the site. The purpose of the proposed plan is to inform and solicit the views of the affected community regarding the Department's preferred alternative to address chemicals of concern in the soil and groundwater at the site. On May 22, 2018, the Department hosted a public meeting and a public comment period ran from May 2, 2018, to June 15, 2018. Based on available information, the preferred option proposed for public comment is to use monitored natural attenuation for treatment of contaminated groundwater and turn the soil vapor extraction system back on if VOCs concentrations were to increase. The Department will prepare the Record of Decision, which will document the final decision regarding the selected alternatives, after the Department considers all comments from the public.

General Geologic and Hydrologic Setting:

The HCI Chemtech - Stillwell Street site is located within the 20-year flood plain along the south side of the Missouri River. The topography is generally level.

The site is underlain by about 120 feet of moderately- to highly-permeable alluvium composed of interbedded sand, gravel, and clay. The alluvium is underlain by the Pennsylvanian-age Kansas City Group, which is composed of interbedded limestones and shales with low to moderate permeability. The alluvial aquifer receives recharge through surface water infiltration, as well as through discharge from the surrounding Pennsylvanian-age bedrock. In general, groundwater within the alluvium flows toward the Missouri River with hydraulic gradient and actual groundwater flow direction dependent upon fluctuating river levels. Site contaminants could potentially discharge to the Missouri River.

Public Drinking Water Advisory:

The cities of Independence and Liberty have well fields approximately eight miles downstream, and the nearest surface water intake is approximately 45 river-miles downstream. No impacts are expected.

Health Assessment:

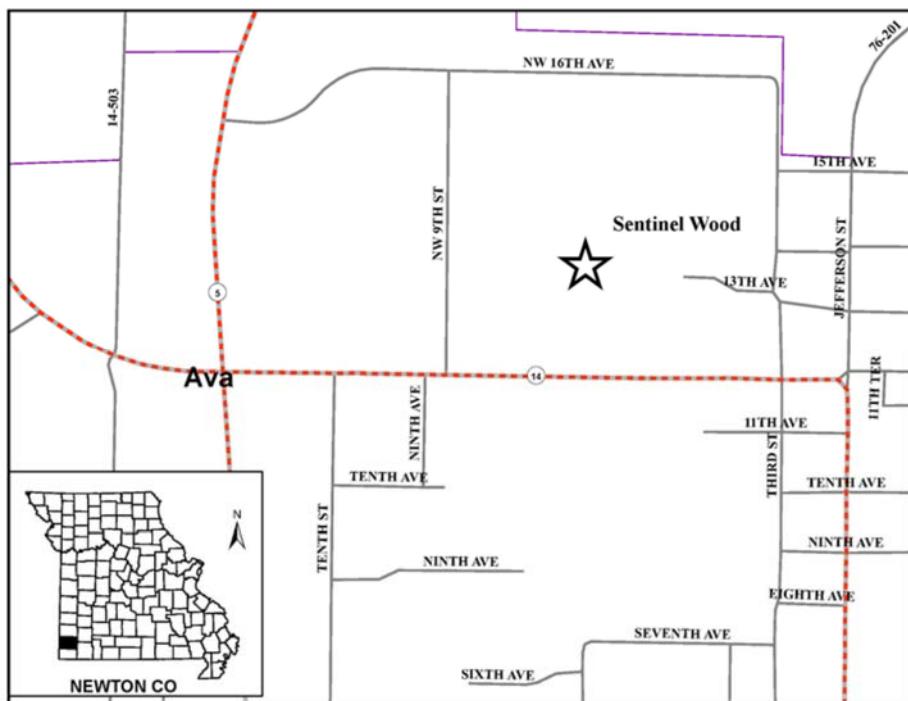
The following are the major contaminants of concern: VOCs and SVOCs. Concentrations of benzene, toluene, ethylbenzene, and xylene in groundwater exceeded EPA's drinking water standards, the maximum contaminant level. Other substances found include dichloromethane, vinyl chloride, 1,1-dichloromethane, and acetone. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

In June 2018, the Department of Health and Senior Services recommended additional sampling to determine if vapor intrusion is a concern for on-site workers.

Based on available information, the site represents a possible human health threat, with on-site workers being at greatest risk, although no exposure is known to exist at this time.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Sentinel Wood Treating



Site Name: Sentinel Wood Treating

Classification: Class 2

Date of Registry Placement: September 11, 1998

Site Address: 412 NW 12th St., Ava, Douglas County, Mo.

Present Property Owners: Sentinel Industries, Inc.

Lead Agency: U.S. Environmental Protection Agency (EPA)

Waste Type: Pentachlorophenol (PCP), arsenic, and 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

Quantity: Not determined

Site Description:

Sentinel Wood Treating is a former wood treating facility that used pentachlorophenol (PCP) and diesel fuel in its wood pressure-treatment process in the 1960s-70s. Sludge from the pressure-treating process was deposited in three on-site lagoons. Wastewater lagoons on site were filled in, and a layer of contaminated sludge remains below ground. These lagoons were closed when

pressure-treating wood on-site ceased. A number of investigations have been conducted by the EPA, the Missouri Department of Natural Resources, and the responsible party, Sentinel Industries, Inc. starting in 1984, under a variety of authorities. Sampling results determined that the sludge contains PCP and dioxins, which are a common impurity in PCP. Shallow groundwater under the former lagoons is contaminated with PCP. Both contaminants also have been detected in soils near the former location of the wood treatment area.

Part of the site is now a parking lot and retail shopping center. The site is an EPA-lead cleanup and is enforced by an Administrative Order on Consent.

Environmental Problems and Areas of Concern:

Previous analysis downgradient from the site revealed elevated levels of PCP in the groundwater. In 2002, The Missouri Department of Health and Senior Services tested six private wells near the site and found no detections of PCP or TCDD present. The Department's Public Drinking Water Branch monitors four of Ava's municipal wells and has not detected PCP during monitoring. In 2002, the Department documented PCP and solvents in downstream surface water. In

2017, levels of PCP concentrations had been reduced significantly.

Remedial Actions:

A number of investigations conducted at the site found elevated levels of PCP and other wood treating contaminants in lagoon samples, in shallow groundwater near the lagoons, and at other areas of the property. In 2002, the Department completed an Expanded Site Inspection to define the nature and extent of on-site and off-site contamination and documented PCP and solvents (not attributable to the site) in downstream surface water. The city of Ava's municipal wells, certain private wells, and a spring were sampled. PCP was detected in three private wells at concentrations below EPA's maximum contaminant levels, and no PCP was detected in Ava's municipal wells. In 2002, no detections of PCP or TCDD were detected in six private wells tested by the Missouri Department of Health and Senior Services.

In July 2000, EPA initiated an investigation, which confirmed the presence of elevated levels of TCDD, PCP, and polycyclic aromatic hydrocarbons in the soil and sludge from the lagoon area; found arsenic contamination in the northeastern portion of the site; and revealed low levels of TCDD and PCP in perched groundwater, creek water, and sediments.

In 2004, Sentinel Industries, Inc. committed to conducting removal actions to prevent further release of PCP from the site to downstream surface water and groundwater. The removal actions relocated previous land farming areas and begin excavating and biologically treating soils from the former treatment plant area in dedicated biocells. By December 2007, PCP levels had decreased significantly in surface water downstream of the site. Contaminated soils are treated biologically in biocells. Surface water PCP concentrations continue to remain at low levels downstream of the site except for slightly elevated levels at two locations near the property line.

Sentinel Industries, Inc. oversees the monitoring of surface water, groundwater, and biological treatment, and reports to the EPA on a semi-annual basis. Planned remediation consists of continued operation of PCP treatment in biocells with continued monitoring

of ground and surface water.

General Geologic and Hydrologic Setting:

The site is located on an upland setting in the hilly Ozark Plateau physiographic province. Soils are composed of cherty, silty clay residuum developed from the underlying bedrock, the Ordovician-age Jefferson City Dolomite. Soil thickness is about 20 feet.

Wells in this area produce water from the Ozark Aquifer, which is composed of carbonates and sandstones. The city of Ava has drilled five municipal wells within Section 11. These wells are over 800 feet deep extending into the Gunter Sandstone. Domestic wells in the area extend to depths ranging from 150 to 315 feet. Casing lengths extend from 4 to 294 feet. The Jefferson City Dolomite acts as a leaky confining unit. Contaminants migrating into the subsurface via vertical bedrock fractures or poorly constructed wells could move into domestic water sources, depending on groundwater flow direction and the nature of contaminants.

Surface water flows off site to the south where it enters Prairie Creek. Prairie Creek is a losing stream that flows westward. Contaminants that enter Prairie Creek as runoff may flow several miles to the west, reaching the water table along losing segments of Prairie Creek.

Public Drinking Water Advisory:

The city of Ava uses three deep wells that draw from the Ozark aquifer. One well is located just over 650 feet from this site, one is located approximately a half mile east of the site, and one approximately 1 mile southeast of the site. The well closest to the site is cased 390 feet deep, while the others have over 400 feet of casing. Quarterly monitoring of the city's wells did not detect site-related contamination, and system wells returned to standard annual monitoring for PCP (and other synthetic organic chemicals) May 2009. With continued management of the site, no impacts are expected.

Health Assessment:

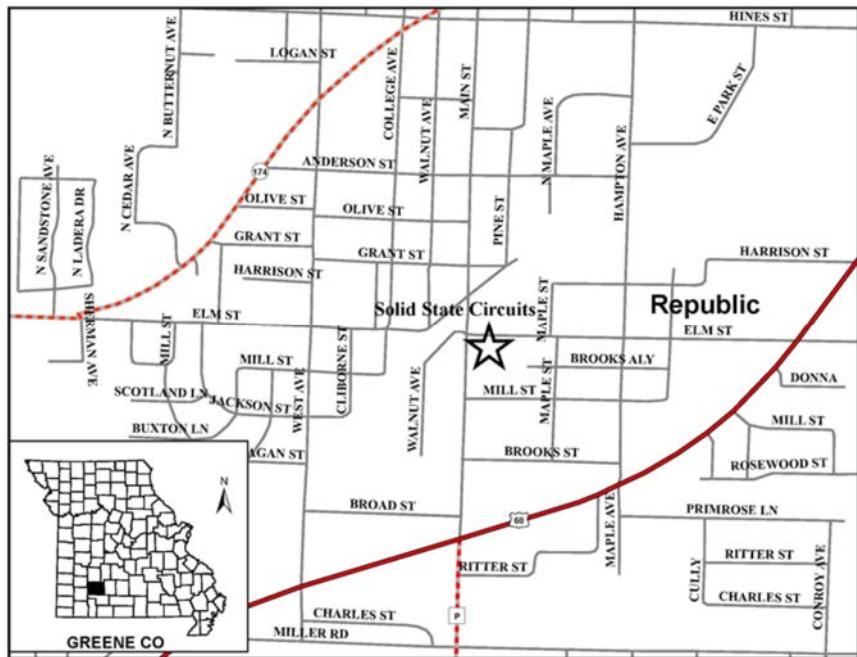
Chemicals of concern at this site include PCP, arsenic, and TCDD. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health

effects associated with these contaminants.

The U.S. Environmental Protection Agency continues to oversee the site and lead actions to treat on-site groundwater and soil. Based on remaining contamination in on-site soils and both on- and off-site water, the site poses a potential health threat.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Solid State Circuits



Site Name: Solid State Circuits

Classification: Class 2

Date of Registry Placement: February 22, 1985

Date of National Priorities List Listing:
June 10, 1986

Site Address: Southeast corner of the intersection of Elm St. and Main St., Republic, Greene County, Mo., Brookline Quadrangle

Present Property Owner: M&M Electric Builders, c/o Michael and Melia Cleveland

Lead Agency: Missouri Department of Natural Resources

Waste Type: Trichloroethene (TCE)

Quantity: Not determined

Site Description: The Solid State Circuits (SSC) site covers approximately 0.5 acre in downtown Republic and consists of a fenced, graded and landscaped area with one outbuilding used to store equipment.

Environmental Problems and Areas of Concern:

The original building was constructed prior to 1902, with a four story northern end and the rest as one story. Numerous businesses operated on site through the years and little is known about chemicals used. SSC manufactured printed circuit boards at the site from 1968 through 1973 in the building's north end. SSC used volatile organic compounds in the manufacturing and plating process, and used TCE in the cleaning process. Due to a lack of viable records, a reliable estimate of the volume of hazardous substances used or released is not available.

SSC reportedly stored TCE in the basement near the basement well. Improper management by SSC of spent volatile organic compound solutions caused the on-site and off-site contamination of surface and subsurface soils, air, utility conduits, and groundwater. Off-site contamination in groundwater reached Republic's municipal water supply (CW-1) well, although the first affected date of the well is unknown.

In 1979, a fire destroyed the northern end of the old Solid State Circuits building. As part of the post-fire clean-up, the property owner pushed rubble into the basement and the area was covered for use as a parking lot. In June

1982, the Department collected water samples from Republic's three municipal wells as part of a nationwide municipal well survey. From this Department sampling, TCE was detected in CW-1. The EPA and the Department (agencies) conducted soil and groundwater sampling around and below the building's northern end. The agencies sample results discovered volatile organic compound contamination in on-site soils and groundwater. The TCE contamination detected in CW-1 triggered further investigations. Between April 1983 and March 1984, the agencies initiated response actions to identify contaminant sources and to further investigate the TCE occurrence in CW-1. The agencies identified the former SSC plant as the source of the TCE contamination in soils and groundwater.

Three groundwater systems or aquifers underlie the site: (1) the Unconsolidated/Fractured Shallow Bedrock System, (2) the Shallow Bedrock Aquifer, and (3) the Deep Bedrock Aquifer. Volatile organic compounds, primarily TCE, contaminated all three aquifers. The Deep Bedrock Aquifer is the primary source of drinking water for Republic. The basement well in the old Solid State Circuits building served as a direct pathway for TCE to enter the Deep Bedrock Aquifer.

Of Republic's three original municipal wells (CW-1, CW-2 and CW-3) and the three new municipal wells (CW-4, CW-5 and CW-6), CW-1 was the only well impacted by the site-related contamination and was closed by the city of Republic due to the TCE contamination. In fall 1997, the city of Republic closed CW-2 that was located 2,100 feet east-southeast of the site, due to non-site related issues. CW-3 is 4,900 feet northeast of the site. The city of Republic constructed CW-4 and CW-5 and brought the wells online by 1988. As part of the annual inspections, the Department conducts regular inspections of CW-3, CW-4, and CW-5, which draw water from the Deep Bedrock Aquifer and serve the city of Republic. In July 2007, Municipal Well #6 (CW-6) went online in the consolidated area of Republic-Brookline. The Department, EPA, and the responsible parties (Missouri Remedial Action Corporation (MRAC)) continue to conduct joint annual site inspections and groundwater sampling events for the Solid State Circuits site.

Remedial Actions:

Following identification and confirmation of the contamination source, EPA completed a number of removal actions. EPA excavated more than 2,000 cubic yards of contaminated material from inside the basement foundation and disposed at a permitted disposal facility. The basement's well, which served as a conduit for contaminant migration, was plugged by the EPA to prevent the further spread of contaminants.

EPA placed the site on the National Priorities list June 10, 1986.

In summer 1989, SSC completed the Remedial Investigation/Feasibility Study with Department oversight. The remedial investigation identified TCE contamination in the groundwater in each of the three hydrologic systems underlying the site.

On August 14, 1989, the Department released the Remedial Investigation/Feasibility Study and the proposed plan to the public for review and comment. The Feasibility Study evaluated four remedial alternatives. After considering the public's comments, EPA, with the Department's concurrence, selected a remedial action to be implemented at the SSC site. On September 27, 1989, EPA signed the Record of Decision.

The selected remedy in the Record of Decision included: (1) extraction of volatile organic compound-contaminated groundwater using existing and new wells; (2) on-site treatment of the extracted groundwater using the two existing air strippers; (3) discharge of treated water to Republic's sewer system to receive further treatment at the Publicly-Owned Treatment Works; (4) a municipal ordinance to prevent construction of drinking wells in or near the contaminated groundwater plumes; and (5) continued monitoring to determine the effectiveness of the remedy.

EPA invited MRAC to participate in formal negotiations for a settlement to conduct or finance the Remedial Design/Remedial Action at the SSC site in accordance with the Record of Decision. From December 1989 through May 1990, SSC, EPA, and the Department negotiated the terms of a Consent Decree/Statement of Work for the Remedial Design/Remedial Action. On July 2, 1990, SSC signed the consent decree, and entered it with

the court May 31, 1991.

The Pilot Remediation Program operated from September 1991 until January 1992, and consisted of on-site treatment of the extracted groundwater using air strippers. The agencies determined the removal effectiveness of TCE was between 98 to 99 percent. In December 1992, the agencies reviewed and approved the remedial design proposal for the cleanup of the groundwater. MRAC began construction of the remedial action in early 1993, and MRAC, with Department oversight, completed it in December 1993. Groundwater extraction from each of the three hydrogeologic systems and remediation via the pump-and-treat system began after construction. The agencies jointly determined the remedy was operational, functional, and performing as designed May 1994. The estimated time to remediate the SSC site is estimated from 20 to 40 years.

In 1996, the Department completed the first Five-Year Review and determined the remedial action and the ongoing operation, maintenance, and monitoring at the SSC site were functioning and performing as designed, and continued to be protective of human health and the environment.

In July 1997, MRAC proposed injecting clean water into a horizontal well to assist in remediating TCE contamination in the unfractured shallow bedrock, thus enhancing the groundwater remedy. MRAC also presented (1996) groundwater data and results from geophysical testing and dye tracings for the agencies to use to evaluate the implementation of a pilot project for the horizontal well. The agencies approved the construction of the horizontal well.

MRAC constructed the horizontal well in 1998 in an arching, north-south direction overlying the Main Street fracture system between the SSC site and the intersection of Main and Mill streets. MRAC conducted clean water injection pilot testing in 2001 and 2002, which determined the well was operational. In 2002, the Department completed the second Five-Year Review and determined the remedial action and the ongoing operation, maintenance, and monitoring were functioning and performing as designed, and continued to be protective of human health and the environment. MRAC began full-time clean water injections through the horizontal well to

assist in remediating the UFSB on July 1, 2003. On September 29, 2004, the EPA with Department concurrence granted the permanent modification to the extraction system via an explanation of significant differences. EPA completed, and the Department concurred on, the third Five-Year Review report September 2007 and determined the Remedial Action functioned as intended and met the performance criteria of the consent decree. The horizontal well continued to operate until the December 8, 2011. A fire totally destroyed the groundwater pump-and-treat (Remedial Action) operational facility on December 8, 2011, creating a Force Majeure/Excusable Delay situation. The agencies and MRAC negotiated and signed a Force Majeure/Excusable Delay Agreement June 15, 2012. During its operation, the horizontal well treated and discharged over 13 million gallons of groundwater under an Underground Injection Control permit.

The Department with EPA concurrence and MRAC continue to renew the Force Majeure/Excusable Delay Agreement to allow work to continue towards completion. The signing of the Force Majeure/Excusable Delay Agreement by the Department and MRAC extended the Agreement until June 2019.

The Department completed, and EPA concurred with, the fourth Five-Year Review report September 2012. Due to continuing unresolved issues, a protectiveness determination could not be made. Site work continued under the Force Majeure/Excusable Delay Agreement to resolve the protectiveness determination.

The Force Majeure/Excusable Delay Agreement was developed as a guide to conduct future site activities. The agreement outlines remedial actions, including soil remediation under the pilot programs, continued groundwater/surface water and soil sampling/monitoring, and the completion of a focused feasibility study. The focused feasibility study will contain an updated site conceptual model, an updated Human Health Risk Assessment, an updated Screening Level Ecological Risk Assessment, and an evaluation of future remedial action alternatives for the SSC site.

MRAC identified three soil source areas during the Supplemental Site Investigation, which were treated in December 2012

(Area 1) and October 2015 (Areas 2 and 3). The re-installation of on-site wells was completed in January 2013. MRAC conducted geophysics on three wells (SSC-29, SSC-3A and SSC-6C) in December 2014 that were reconfigured January 2015. MRAC submitted a report documenting site activities to the agencies in January 2015. The remediation of Areas 1 and 2 and 3 is ongoing and should continue throughout 2018. MRAC will conduct verification soil and groundwater sampling in early 2019.

The continued groundwater/surface water monitoring/sampling has allowed for the evaluation of the effects of the pumping cessation and the effects of Area 1 and Areas 2 and 3 pilot program remediation efforts for on-site and off-site groundwater. These site-related actions and the results are chronicled in ongoing reports.

The Department and EPA completed and signed the fifth Five-Year Review report on September 19, 2017. The protectiveness determination still could not be made since ongoing pilot study activities continued past the fifth five-year review deadline. Once MRAC completes the ongoing pilot study activities and further data and information is obtained, under the Force Majeure/Excusable Delay Agreement, the agencies should be able to resolve the protectiveness determination.

General Geologic and Hydrologic Setting:

The SSC site is located in a broad, upland setting with regional karst development. Small spring and cave systems exist in and around Republic. Rocks of Mississippian- and Ordovician-age underlie most of the region. The subsurface geologic units have been divided into three hydrogeologic layers: the Unconsolidated/Fractured Shallow Bedrock System, the Shallow Bedrock Aquifer, and the Deep Bedrock Aquifer.

The Unconsolidated/Fractured Shallow Bedrock System includes 10 to 20 feet of stony, red, clay residuum and about 75 feet of Mississippian-age Burlington-Keokuk Limestone, consisting of weathered and fractured, cherty limestone. This zone is moderately to highly permeable, with fractures that have provided avenues of rapid fluid transport to groundwater. Regional groundwater flow of the Unconsolidated/

Fractured Shallow Bedrock System is south-southeast toward the Schuyler Creek drainage system. Perched water is thought to be present at the soil-bedrock contact.

The Shallow Bedrock Aquifer includes the lower, unfractured Mississippian-age Burlington-Keokuk Limestone, which ranges from about 75 feet to 300 feet below the surface. Regional groundwater flow in the Shallow Bedrock Aquifer is toward the southeast.

The Deep Bedrock Aquifer includes deep, Ordovician-age dolomite and sandstone bedrock below a confining unit, which is present at depths of over 300 feet.

TCE contamination from the SSC sites impacted all three hydrogeological systems. Primary routes of contaminant migration are along fractures in the shallow aquifer. Migration down an abandoned well that penetrated the confining layer contaminated the deeper aquifer.

Public Water Drinking Water Advisory:

The city of Republic currently uses four deep wells that draw from the deeper Ozark aquifer. The closest well to this site is approx. 0.9 miles east of the site, with the second approximately 1.2 miles to the west. Both of these wells are cased at least 450 feet deep. The other two system wells are several miles from the site. Although TCE contamination affected both the shallow and deep aquifers in this region, it is unlikely that the city of Republic's public water source is at risk.

Health Assessment:

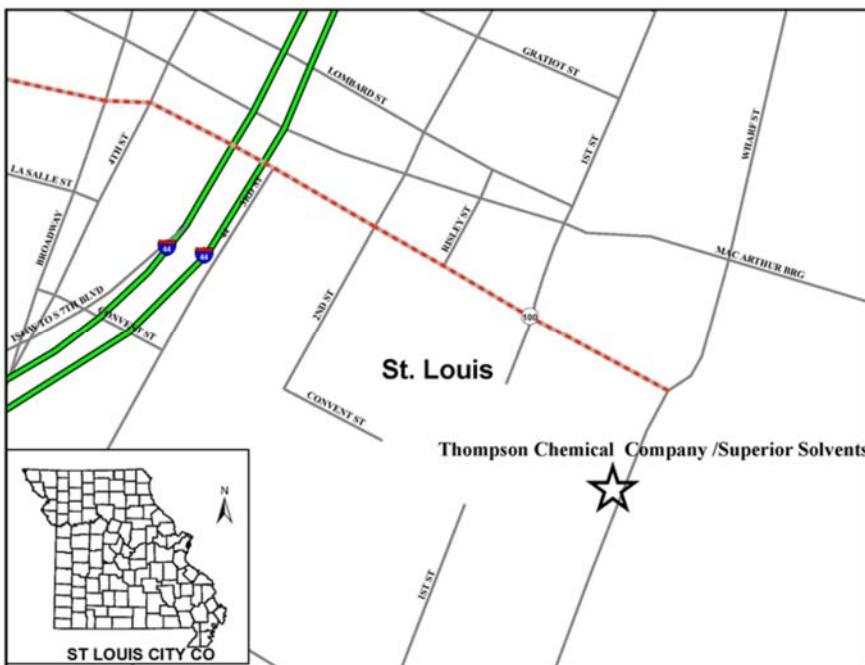
The contaminant of concern at this site is TCE. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

The exposure route of greatest concern is ingestion of contaminated groundwater, although private well sampling does not indicate that this is presently occurring. Samples collected between 2002 and 2017, by the Missouri Department of Health and Senior Services, from private wells at the southern and southeastern edges of town, did not detect TCE or its breakdown products.

Due to the proximity of the facility to city residences and the previous contamination of the city's drinking water supply, a potential health threat exists at this site. While Department of Health and Senior Services testing of private wells is not detecting TCE, with the pump-and-treatment system non-functional, groundwater plumes should continue to be monitored.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Thompson Chemical/Superior Solvents



Site Name: Thompson Chemical/Superior Solvents

Classification: Class 2

Date of Registry Placement: Sept. 23, 1986

Site Address: 60 Chouteau Ave., St. Louis, Mo.

Present Property Owners: Superior Solvent and Chemicals, a subsidiary of Superior Oil Company of Indianapolis, Ind.

Lead Agency: U.S. Environmental Protection Agency (EPA)

Waste Type: Polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), and semi-volatile organic compounds (SVOCs)

Quantity: Not determined

Site Description: This site is located near the west bank of the Mississippi River in a historically industrial area of the city of St. Louis. Part of the site was used by Thompson Chemical Company for production of Agent Orange from about 1950 to 1968. Wood Treating Chemicals Company used a part of the property to formulate pentachlorophenol

(PCP). EPA's sample results at the site in 1984 detected TCDD, a waste byproduct from the production of Agent Orange; VOCs; and PAHs. Superior Solvents operated as an active solvent distribution business at the site until the company moved to a new facility May 2014. The site is a three-acre vacant lot with one building surrounded and secured by a fence with a locked gate.

Environmental Problems and Areas of Concern:

Off-site exposure of pedestrians and on- and off-site exposure of industrial workers to surface and subsurface contamination is possible. Also, the ecosystem in the Mississippi River could be exposed to contaminants due to the site's proximity to the river.

Remedial Actions:

In 1984, EPA completed a Preliminary Assessment and a Site Investigation. Sampling confirmed the presence of contaminants in soil and located a leaking underground storage tank. TCDD contamination in soils ranged from one part per billion-160 parts per billion.

In 1987, EPA conducted additional sampling and found contamination seeps in the Mill

Creek Trunkline Sewer. Also in 1987, the responsible party excavated the underground storage tank contents and surrounding soils. The contaminated soils were stored on site in 13 roll-off boxes.

In 2006, EPA approved an Engineering Evaluation/Cost Analysis and signed an Action Memorandum. In 2007, EPA issued a draft Administrative Settlement Agreement and Order on Consent for removal action, and the responsible parties submitted a revised Administrative Settlement Agreement and Order on Consent for agency review. EPA continued to negotiate with the responsible parties to implement the remedial action as defined in the Action Memorandum: 1) properly dispose of the 13 on-site roll-off boxes and drums, and 2) excavate contaminated on-site berm soils and properly dispose. On July 23, 2013, the responsible parties and EPA approved and signed the Administrative Settlement Agreement and Order on Consent. The responsible parties began the remedial action field work August 2013, and completed the field work November 2013. On January 24, 2014, EPA approved the final remedial action report.

Superior Solvents and Chemicals purchased property in Arnold, Mo, in 2013. The company constructed a new facility and completed its move to the new Arnold facility by May 2014. In March 2018, the Missouri Department of Natural Resources discussed with EPA the site status and a potential path forward and shared its thoughts regarding issues that need to be addressed from a Resource Conservation and Recovery Act perspective.

The Department conducted an annual inspection on May 29, 2018. The inspection noted that the cap is a combination of asphalt and concrete, and vegetation is growing through the cracks and seams of the cap, with woody vegetation growing in the area of the former tank containment area. Trespassing on the property is evident by the graffiti painted on the on-site building.

General Geologic and Hydrologic Setting:

This site is approximately 300 feet west of the Mississippi River. This area is an alluvial remnant of the Mississippi River, altered by man-made fill material. Man-made levees to the east provide partial protection from

floodwaters. Surface drainage and storm sewers flow to the east and enter the Mississippi River within 400 feet. Numerous sinkholes exist west of this site where the Mississippian-age bedrock lies close to the surface.

The subsurface soils consist of an upper zone of man-made fill and debris from the existing ground surface to a depth of 18 to 23 feet. The extremely heterogeneous fill is composed of dirt, cinders, brick, scrap concrete and other debris. Permeability in this unconsolidated zone is expected to be relatively high.

Approximately 35 feet of alluvial clay, silt and sand underlie the fill material. The upper cyclic strata of silts and clays (10 to 15 feet thick) are underlain by fine- to medium-grained alluvial sand, with some gravel, cobbles, and clay seams. The sand stratum, which varies in thickness from about 10 to 20 feet, appears to slope eastward toward the Mississippi River and is probably exposed in the river bed. Permeability of the sand varies considerably; consequently, a corresponding variation occurs in the rate of groundwater flow in the alluvium.

The St. Louis Limestone underlies the unconsolidated material on site at an approximate depth of 50 feet below the surface. Karst features have developed in this unit to the west of the alluvial area.

Most water movement is to the east, toward the Mississippi River via surface drainage or through permeable alluvium. The potential for infiltration into shallow alluvial groundwater supplies is high. The risk to bedrock groundwater supplies is reduced since the site is located in a discharge environment. However, groundwater supplies in the shallow bedrock could be affected by dense non-aqueous phase contaminants in high concentrations.

Public Drinking Water Advisory:

The city of St. Louis draws source water from the Missouri and Mississippi rivers, but all active intakes are upstream from this site. Illinois American Water – East St. Louis has one surface intake approximately two miles upstream from this site. The city of Chester, Illinois, and the Menard Correction Center Department (Chester, Ill.) have surface water

intakes approximately 68 river-miles downstream from this site. No impacts to any public water sources are expected.

Health Assessment:

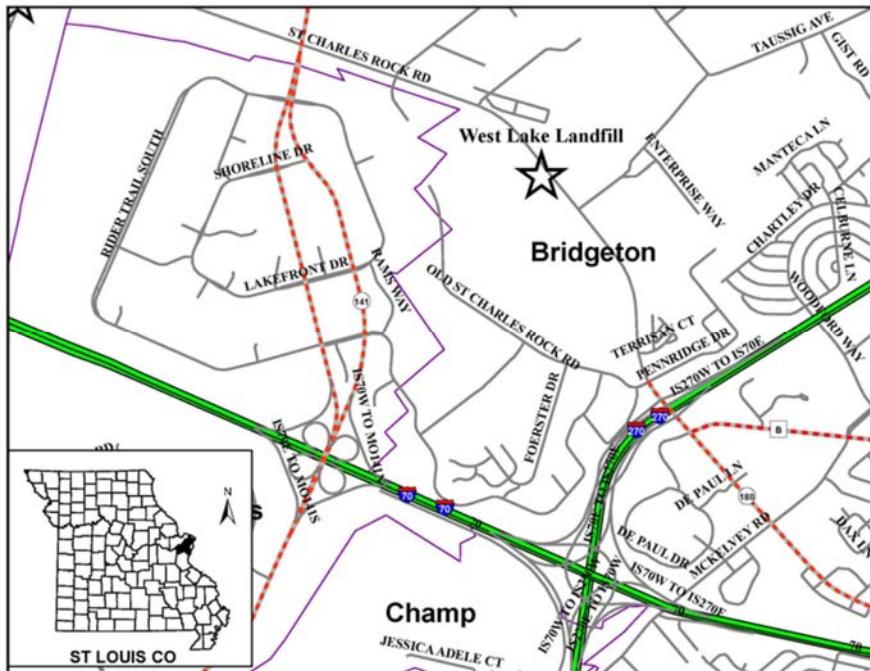
The chemicals of concern at this site include PAHs, VOCs, TCDD, and SVOCs. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Contaminants could possibly reach the river, either through the groundwater or through the sewer system. Although now remediated, the site once contaminated the adjacent Mill Creek sewer. Department of Health and Senior Services are not aware of any groundwater use for drinking purposes in this area.

Based on available information, the site poses a potential health risk due to the noted vegetation growing through seams present in the cap, on-site trespassing, and the potential for contamination of the Mississippi River.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102; 573-751-6102.

West Lake Landfill



Site Name: West Lake Landfill

Unknown volume for Operable Unit 2.

Classification: Class 2

Date of Registry Placement: February 22, 1985

Date of National Priorities List Listing:
August 30, 1990

Site Address: 13570 St. Charles Rock Road, Bridgeton, St. Louis County, Mo., between Old St. Charles Rock Road and St. Charles Rock Road east of Earth City, T. 46N, R. 5E, St. Charles Quadrangle

Present Property Owner: Rock Road Industries, Inc.

Lead Agency: U.S. Environmental Protection Agency

Waste Type: Radionuclides, industrial wastes, and municipal wastes

Quantity: Approximately 8,700 tons of uranium ore-processing residue wastes were the primary source of radionuclides for Operable Unit 1. These wastes were mixed with approximately 39,000 tons of soil obtained from the Hazelwood Site, and transported to West Lake Landfill to be used for solid waste landfill operations.

Site Description: The approximate 200-acre West Lake Landfill site is divided into three operable units.

- Operable Unit 1 includes two inactive landfill areas (Area 1 and Area 2) and an area known as the Buffer Zone/Crossroad property; these are areas known to contain radiologically impacted material. The radiological waste was delivered by dump trucks to the site in 1973. Records indicate that about 8,700 tons of leached barium sulfate containing about 7 tons of uranium were mixed with about 39,000 tons of topsoil from the Hazelwood site, and transported to the landfill.
- Operable Unit 2 is divided into several solid waste disposal areas including a former active sanitary landfill (known as Bridgeton Sanitary Landfill), the pre-law inactive demolition landfill, and parts of another pre-law inactive sanitary landfill. These pre-law landfills closed before Subtitle D regulations were in place.

- Operable Unit 3 consists of groundwater impacted by wastes disposed at the site. Groundwater is present within the alluvium and bedrock deposits beneath the site. Historical and recent groundwater sampling show concentrations above the maximum contaminant level for certain radionuclides, trace metals, and volatile organic compounds.

The property also includes an active waste transfer station, a leachate pre-treatment facility, and an asphalt plant that are not part of the superfund site. The site lies partially within the Missouri River geomorphic flood plain in northwest St. Louis County and is protected by an engineered levee system.

The Responsible parties have placed Environmental Covenants on the entire West Lake Landfill Site property titles to prevent residential development or groundwater use from occurring. Additional covenants have been placed on the radiologically impacted areas to prevent construction of buildings or utility excavations. Chain link fencing has been erected around the site to restrict public access to the property and additional chain link fencing within the site perimeter to further prevent worker access to radiologically-contaminated areas.

Environmental Problems and Areas of Concern:

Contamination at the site includes organic, inorganic, and radiological chemicals of concern that can be released into leachate, landfill gas, and groundwater. Based upon information collected throughout the site investigation history, there exists a potential threat to on-site users from external gamma radiation and radon gas emissions. More information is included under the section "Health Assessment."

Remedial Actions:

EPA placed the site on the National Priorities List on August 30, 1990, mandating EPA conduct response actions at the site.

The responsible parties and EPA executed an Administrative Order on Consent March 1993 to conduct a Remedial Investigation/Feasibility Study of the radiologically-contaminated portions of the landfill (Operable Unit 1). The responding responsible parties include: Cotter Corporation; Republic Services, Inc.;

Bridgeton Landfill, LLC; Rock Road Industries, Inc.; and the U.S. Department of Energy.

Bridgeton Landfill and EPA negotiated a second Administrative Order on Consent December 1994 to perform a Remedial Investigation/Feasibility Study for the non-radiological waste portions of the landfill (Operable Unit 2, including the Bridgeton Landfill site).

The Responsible Parties have completed remedial investigation reports, baseline risk assessments, and feasibility study reports for both Operable Unit 1 and Operable Unit 2. EPA also prepared proposed plans, held public meetings, and developed records of decisions for the two operable units.

Operable Unit 1: On May 29, 2008, EPA finalized the Record of Decision for Operable Unit 1. The selected remedy for Areas 1 and 2 was to consolidate contaminated soil on the Buffer Zone/Crossroad Property into Areas 1 or 2, regrade Areas 1 and 2, and contain radioactive materials in place by installing a Subtitle D cover system. The selected remedy included long-term groundwater monitoring, institutional controls, inspection, maintenance, and periodic reviews. Negotiations began with the responsible parties to begin the remedial design in 2008, but EPA put this work on hold to perform additional work on the Operable Unit 1 feasibility study.

In January 2010, EPA requested the responsible parties perform a supplemental feasibility study to further evaluate excavation and disposal remedies for radiologically-impacted material against the selected remedy of capping in place. In December 2011, the supplemental feasibility study was finalized.

EPA requested additional work to the supplemental feasibility study to include more detailed evaluations of the partial excavation alternative, alternative landfill cap designs, and treatment technologies, as well as a fate and transport study October 2012. EPA also requested additional quarterly rounds of groundwater sampling continue into 2013. EPA conducted a downhole gamma survey November 2012, as well as a gamma and infrared flyover March 2013.

EPA ordered additional remedial investigation to improve the resolution of the known extent

of radiologically-impacted material with additional soil borings in Area 1 and Area 2 in 2015. EPA's intent for the additional investigation was to supplement existing data to support a statistical analysis of the extent of radiologically-impacted material in order to improve alternative analyses in the final feasibility study. The investigation activities also included fate-and-transport testing to determine the need for creating Operable Unit 3 for groundwater.

EPA and responsible parties entered into an Administrative Order on Consent for fire prevention measures in response to a small brush fire on site December 9, 2015. Activity included de-vegetation and placement of non-combustible cover over portions of Area 1, Area 2, and the Buffer Zone where radiologically-impacted material is at or near the surface. Implementation of a site-wide Incident Management Plan also was included in the Order. The non-combustible cover was installed over those portions of Areas 1 and 2 where radiologically-impacted material is present at the ground surface in 2016. In addition to reducing the potential for a surface fire, the cover may reduce the potential for exposure due to migration of dust and direct contact with soils, which is inspected and monitored regularly by a number of entities.

EPA released its list of 21 sites from across the U.S. targeted for "immediate and intense action" December 8, 2017. Region 7 named West Lake Landfill, the only Missouri site, as one of two sites for this "immediate and intense action."

EPA announced a plan to amend the 2008 Operable Unit 1 Record of Decision February 2018, concluding that the presumptive remedy chosen in 2008 is no longer acceptable due to the presence of radiologically-impacted material (RIM) at levels indicative of principal threat waste. The plan proposed to modify the 2008 remedy to include partial excavation of radiologically impacted material, and an improved cover over the RIM left in place.

EPA signed a Record of Decision Amendment on September 27, 2018, finalizing its decision to excavate RIM in Areas 1 and 2 at concentrations greater than 52.9 pCi/g (Ra-226 + Ra-228 or Th-230 + Th-232) generally down to a depth of 12 feet below the 2005 ground surface, and dispose off site in a permitted facility. The remedy includes

excavation of RIM in the Buffer Zone and Lot 2A2 to background levels, and also includes: engineering and institutional controls to restrict future uses of the site and ensure the integrity of the engineered cover; long-term surveillance and maintenance; groundwater monitoring; storm water controls; gas monitoring and controls, as needed; and leachate management and control as needed.

Operable Unit 2 Actions: EPA signed the Record of Decision for Operable Unit 2 July 25, 2008. The selected remedy for Operable Unit 2 is also based on the presumptive remedy for municipal waste landfills that pose a relatively low long-term threat or where treatment is impracticable. After the respondents performed a streamlined site evaluation, EPA selected the remedy of containment in place for the inactive sanitary landfill using an engineered landfill cover system, long-term monitoring, maintenance, institutional controls, inspections, and periodic reviews. The Closed Demolition Landfill and the Former Active (Bridgeton) Sanitary Landfill were deferred to state and local regulation.

In December 2010, Bridgeton Landfill, LLC, a responsible party for the site, reported elevated temperatures in the Former Active Sanitary Landfill. This landfill area consists of two former sanitary landfill units: the North Quarry and the South Quarry. The thermal reaction began in the South Quarry and developed into a subsurface smoldering event. The Department's Solid Waste Management Program oversees the remedial activities for the subsurface smoldering event.

Bridgeton Landfill entered into an Agreed Order with the state of Missouri to address the subsurface smoldering event and control emissions and odors May 13, 2013. Under the order, Bridgeton Landfill, LLC established the necessary infrastructure to isolate, contain, and monitor the subsurface smoldering event, including modifying the South Quarry gas and leachate collection systems, installing a synthetic cap over all of the South Quarry and most of the North Quarry, and constructing an on-site leachate treatment system.

Preventing Subsurface Smoldering Event Migration to Operable Unit 1

To address concerns about the migration of the subsurface smoldering event into Operable Unit 1, Bridgeton Landfill, LLC installed: 13 gas interceptor wells with 12

converted to employ heat loops; a new heat extraction system containing 16 additional wells; and temperature monitoring probes to monitor migration between the South Quarry and the North Quarry.

On April 16, 2014, EPA and responsible parties entered into an Administrative Order on Consent to perform preconstruction work for an isolation barrier between the subsurface smoldering event and radiologically-impacted material in Area 1.

On April 28, 2016, EPA and the responsible parties entered into an Administrative Order on Consent for subsurface smoldering event management; elements of the order include: implementation of the above-mentioned heat extraction system; contingent actions such as implementation of inert gas injection wells; installation of additional temperature monitoring stations; installation of two SO₂-monitoring probes and collection of the data for a one-year period; and phased installation of ethylene vinyl alcohol cover over the North Quarry area.

On June 25, 2018, the state of Missouri and the responsible parties entered into a final consent judgement for the Bridgeton Landfill portion of OU-2, settling alleged violations of Missouri's environmental regulations and asserting common-law claims related to the subsurface event at the Bridgeton Landfill. The settlement imposes maintenance, monitoring, and mitigation requirements on Bridgeton Landfill; commits Bridgeton Landfill's parent company, Republic, to guarantee and financially assure those activities; and provides restitution to the community.

Operable Unit 3: Operable Unit 3 consists of contaminated groundwater at the site. The Responsible Parties sampled groundwater on property from 2012 to 2014, and results indicate that site-related contamination is present in some of the monitoring wells located at the property boundary, both on the west and northwest. Although health-based goals and limits are exceeded in these monitoring wells, there are no current or foreseeable domestic uses of groundwater. EPA is negotiating an order for Operable Unit 3 remedial investigation.

General Geologic and Hydrologic Setting:

The West Lake Landfill site has existed since the 1950s. Landfilling occurred by excavation and filling on the Missouri River geomorphic flood plain and by filling in a limestone quarry adjoining the flood plain landfill. The quarry is in the St. Louis Limestone, which crops out along the eastern slopes of the Missouri River flood plain. The area is protected from flooding by the Earth City Levee system, which is designed to exceed 500-year flood levels.

The Missouri River alluvium consists of 15 to 20 feet of silt loam to very silty clay, with moderate permeability. The groundwater table occurs at depths of 15 to 20 feet below flood plain level. Fluctuations of 5 to 15 feet occur when prolonged wet seasons affect the level of the Missouri River.

Beneath the very silty clay, the Missouri River alluvial sediments are characterized by a general increase in grain size associated with increasing depth. Sand becomes noticeable at depths of 20 to 30 feet, with gravel beginning to occur at depths of 30 to 40 feet.

Public Drinking Water Advisory:

No active public water wells are located near the West Lake Landfill. Missouri American Water – St. Louis Co./St. Charles Co. uses surface water from the Missouri River as a source, but the nearest intake is approximately five miles downstream from this site. No impacts to public water sources are expected.

Health Assessment:

Based upon a 2018 remedial investigation addendum's site-specific risk assessment, under current land use conditions, risk from exposure to site-related soil contamination for both on-site (Area 1, Area 2) and off-site (Buffer Zone/Crossroad property (Lot 2A2)) receptors evaluated does not exceed acceptable risk thresholds (e.g., one in 10,000 chance of the excess individual lifetime cancer risk). Assuming distant future exposures (1,000 years into the future) and in the absence of controls, the excess individual lifetime cancer risk from exposure to radionuclides is estimated for on-site receptors, and approaches the risk threshold for off-site receptors. Radionuclides include

the uranium series (uranium-238, uranium-234, thorium-230, radium-226, and lead-210), thorium series (thorium-232, radium-228), and the actinium series (uranium-235 and protactinium-231).

For non-cancer risk, excess risk exists only for future exposures on site, limited to exposure to zirconium and cobalt in soil.

Health effects for radionuclides and the inorganics zirconium and cobalt are presented in Appendix A, Health Effects Assessment Table.

In the past, Missouri Department of Health and Senior Services completed an exposure assessment that included a well survey, water sampling, and a health questionnaire for the site. Water samples from private drinking water wells in the vicinity of the site (i.e., within a 1-mile radius) were collected, in 1988 and 1989, for radiological contaminant (gross alpha) and pesticide analysis. Results of the questionnaire did not reveal any patterns of adverse health effects consistent with the hazardous materials at the landfill. None of the water samples had gross alpha levels exceeding EPA's maximum contaminant level of 15 picocuries per liter (15 pCi/L). Pesticides were not detected in the water samples. The wells that were tested are no longer in use.

On- and off-site air sampling data is publicly available on EPA's website. Routine air sampling on- and off-site includes gross alpha and gross beta, radon, gamma spectrometry and dose, and volatile organic compounds. Results of sampling of off-site air during the period of April 2014 to July 2015 are indicative of urban background. Results of on-site sampling for the period of August 2017 to May 2018 show the isotopic and gamma spectroscopy results for uranium-238, thorium-230, and combined radium are below Nuclear Regulatory Commission limits for public exposure. The results for gross alpha, beta, and volatile organic compounds are generally consistent with EPA's previous year-long monitoring effort at five off-site locations, including one monitoring station placed in Spanish Village.

EPA required collection and radiological analysis of storm water and sediment samples. Storm water results were compared to, and found to be less than, the risk-based screening levels calculated by EPA. Missouri

Department of Health and Senior Services concluded that the exposure scenario used for the calculation is reasonable. Analytical results for the sediment samples, except for one, are below threshold levels defining radiologically-impacted material.

Due to a heavy rainfall event April 2017, the Department collected and performed radiological analysis of storm water samples. The results indicate that the level of activity in the samples are typical for the levels of radioactivity in storm water samples and are not indicative of a release from West Lake Landfill.

To assess current storm water contamination, Missouri Department of Health and Senior Services compared 2018 storm water results to screening levels calculated using EPA's recommended exposure scenario for an adult. Missouri Department of Health and Senior Services reviewed the scenario and concluded that the exposure scenario used for the calculation is reasonable. Therefore, based upon these screening levels, storm water was found to be less than the risk-based screening levels calculated using EPA's exposure scenario for an adult receptor.

Results of comprehensive groundwater sampling performed between 2012 and 2014 indicate that site-related contamination is present in some of the monitoring wells located at the property boundary, both on the west and northwest. Although the health-based goals are exceeded in these monitoring wells, there are no current or foreseeable domestic uses of groundwater. Because the health-based goals are based upon domestic use of groundwater, risk of adverse health effects from groundwater contamination is not expected.

The Agency for Toxic Substances and Disease Registry released a public health consultation that evaluated radiation in groundwater and air at West Lake Landfill Operable Unit 1 in 2015. The Agency for Toxic Substances and Disease Registry concluded that inhalation of radon gas or dust particles containing uranium and thorium decay products (e.g., radium-226, radium-228) from surface disturbances at Operable Unit 1 may pose a risk to the health of landfill workers, including an increased risk of lung cancer. The Agency for Toxic Substances and

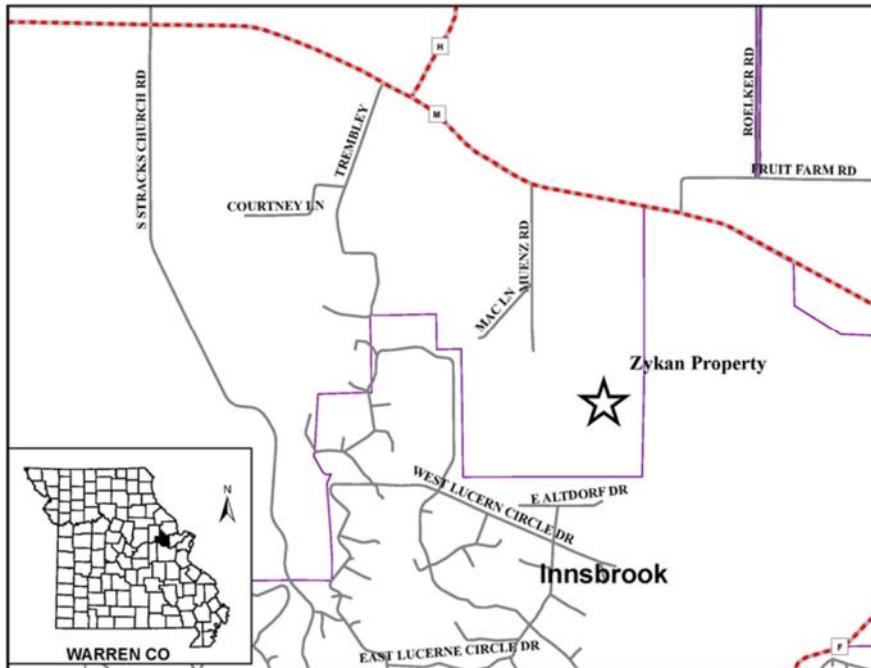
and Disease Registry does not expect that radon gas or radioactivity in groundwater poses increased health risks to the general public, as radon gas concentrations in ambient air have been found to be well below levels of health concern and the groundwater is not used as a public water supply. The Agency for Toxic Substances and Disease Registry recommends due diligence to prevent future migration and contamination.

For Operable Unit 2 (Bridgeton Landfill), acute exposure health messages for daily, weekly, and monthly air quality data are available at Missouri Department of Health and Senior Services' website: <https://health.mo.gov/living/environment/bridgeton/>. Missouri Department of Health and Senior Services are further evaluating chronic ambient air exposures and will release a health consultation. The Department provides additional information for Operable Unit 2 at: <https://dnr.mo.gov/bridgeton/>.

Based on available information, if no site cleanup is done, a potential health risk exists from inorganic and radionuclide contamination at Operable Unit 1 for on-site workers in the distant future. While present exposure has been reduced by current actions on site, the potential for future exposure still exists. Emissions from Operable Unit 2 will continue to be monitored, while Operable Unit 3 is to be reassessed in the near future.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO, 65102-0570, 573-751-6102.

Zykan Property



Site Name: Zykan Property (Zykan Landfill and Bob's Home Service Landfill)

Classification: Class 2

Date of Registry Placement: March 9, 1987

Site Address: 1251 Muenz Road, Wright City, Warren County, MO
S 1/2, S 1/4, Sec. 32, T. 47N, R. 1W, Wright City Quadrangle

Present Property Owner: LaVerne A. Zykan Trust

Lead Agency: Missouri Department of Natural Resources (OU1); U.S. Environmental Protection Agency (OU2)

Waste Type: Inorganics, organics, heavy metals, paints, pigments, pesticides, and ignitable waste

Quantity: Not determined

Site Description: The Zykan Property covers approximately 158 acres, which include a residence, crop land, and two permitted former landfills. The site is located about three miles southwest of Wright City in Warren County. A 30-acre portion of the parcel located adjacent to and east of the two

landfills was sold for back taxes on August 28, 2017. No landfills operated in this 30-acre parcel.

The two permitted landfills located on the Zykan Property are the Bob's Home Service, Inc., Sanitary Landfill (OU1, known as the Zykan Landfill, permit # 0121901), and the Bob's Home Service, Inc., Special Industrial Waste Disposal Facility (OU2, known as the BHS Landfill, permit # 0721901). The BHS Landfill comprises two waste fill areas: the Area 1 landfill filled with industrial wastes and the Progressive Trench Area (PTA) landfill filled with hazardous wastes. The Zykans owned the property where the landfills are located and Bob's Home Service, Incorporated (BHS) was the operator for the landfills.

The sanitary landfill was approved under its permit to fill approximately 14 acres of the site, and operated from 1974 until 1977. Materials disposed at the Zykan Landfill included miscellaneous trash, household garbage and unidentified industrial wastes. Since its closing, many of the suspected industrial wastes have been classified as hazardous substances. Some wastes disposed at the Zykan Landfill were similar to the wastes disposed in the BHS Landfill. The Department's Hazardous Waste Program's

Superfund Section oversaw closure of the Zykan Landfill. Currently, the Department's Solid Waste Management Program is the lead agency on the Zykan Landfill, since they have authority over sanitary landfills.

After the Zykan Landfill closed in 1977, BHS opened the BHS Landfill, permitted for burial of 12 acres of waste. The BHS Landfill began with a nine-acre industrial landfill, known as Area 1 that was located to the north of Zykan Landfill. This Area 1 landfill was subsequently closed in 1982. BHS subsequently opened a three-acre hazardous waste landfill in the permitted BHS Landfill area in 1982, known as the PTA landfill. The PTA landfill was located between the Zykan Landfill and Area 1 landfill. Many different wastes were disposed in the Area 1 and PTA landfills, including volatile organic compounds, petrochemical wastes, herbicides, pesticides, paint waste, and Times Beach flood waste. The PTA landfill operated under federal interim status and a state-issued hazardous waste permit. The PTA landfill was closed in 1985 under a Closure and Post-Closure Plan approved by the Department in 1986.

The Resource Conservation and Recovery Act program acted as the principal authority for the Area 1 and PTA landfills, since BHS was still maintaining the hazardous waste landfills up to 2008. Sometime between 2008 and now, EPA became the lead agency for activities at the BHS landfill.

During the operation of the PTA landfill, BHS was required to pay into a post-closure trust an amount equal to the amount of the closure and post-closure estimate. However, BHS failed to fully fund this trust, and due to a bankruptcy, BHS has not funded the trust since 1990. The Area 1 and PTA landfills are now considered a closed federal interim hazardous waste landfill status facility (designated as BHS for RCRA). In an effort to maintain the landfill, LaVerne Zykan contracted a consultant to take care of minimal post-closure maintenance. Since 1996, the reimbursement of these activities has been paid out of the partially-funded post-closure trust fund, which is nearly depleted.

Environmental Problems and Areas of Concern:

A wildfire burned through a portion of the PTA

Landfill and burned a storage building, waste tires, and miscellaneous scrap and debris in February 2002. Groundwater monitoring and leachate removal was performed at the BHS Landfill's two waste areas, with approximately 10,000 gallons of leachate being removed from the leachate collection sump and disposed off-site at a permitted waste facility in May 2004. Leachate continues to accumulate in the sump. Past groundwater monitoring results indicated volatile organic analysis contamination in a couple wells to the north of the BHS Landfill.

The Department's Environmental Services Program conducted a site investigation at the BHS Landfill (OU2) as part of a 128a Brownfields Grant. The investigation determined that no significant soil contamination existed due to releases from the former waste management units. The results of surface water sampling also indicated no contaminants were migrating off site via surface water. Groundwater samples to the north of the BHS Landfill continued to have detections of volatile organics. The analytical results for samples from the two newly installed microwells indicated the hazardous waste contamination had remained on site.

Ten thousand gallons of leachate were removed from the BHS leachate collection sump in August and September 2008. Groundwater was sampled in 13 monitoring wells in September 2008. The results indicated that several wells detected groundwater contamination above EPA Regional Screening Levels, including vinyl chloride, bis(2-ethylhexyl) phthalate, arsenic, cadmium, chromium, and lead.

The leachate collection sump and interceptor trench monitoring sump were sampled in September 2013. The constituents above EPA Regional Screening Levels were o,p-DDD, barium, iron, and manganese. In January 2014, the constituents found in samples from the leachate collection sump at concentration levels higher than the EPA Regional Screening Levels were chlorobenzene, 1,1-dichloroethane, toluene, naphthalene, barium, manganese, and ammonia.

Remedial Actions:

Hazardous waste remains buried at the Zykan

Property. The Zykan Landfill (OU1) was capped and vegetated when it was closed in 1977. EPA inspected the Zykan Landfill in 1991, documenting erosion and leachate outbreaks, and they instructed the owners to correct these problems. When the owner took no action, EPA issued a notice of violation in November 1991. EPA referred Zykan Landfill to the Department's enforcement section at the St. Louis Regional Office in January 1992. Since the owner was financially insolvent, legal actions were not pursued. From January 1992 through 1995, yearly closure site inspections revealed no remedial actions were undertaken to correct the ongoing leachate outbreak and eroded gullies at the Zykan Landfill. In June 1995, the Department's regional office issued a notice of violation.

A 1996 Registry inspection of Zykan Landfill revealed exposed drums in a drainage ditch leading to Charrette Creek and a leachate outbreak on the south slope. Repairs and drum overpacking activities were completed in the summer of 1996. The Department completed an Integrated Preliminary Assessment/Site Inspection Report that recommended an EPA removal action on August 30, 1996. A Time-Critical Removal Action was completed February 1998. Areas disturbed during the removal were regraded and hydroseeded in the fall of 1998.

EPA obtained a 12-month statutory exemption in January 1999 due to Zykan Landfill's maintenance and security problems. The exemption was continued until April 2000. During that time, security was re-established with the installation of a new fence and gate system. In fall 1999, eroded gullies that had developed due to a lack of vegetation were repaired, and the Zykan Landfill was reseeded.

In 1999, EPA completed an Expanded Site Investigation to assess the threat the Zykan Landfill posed to human health and the environment via surface water and groundwater. Due to previous removal activities at the landfill, the Expanded Site Inspection concluded the site currently posed minimal or no threat to human health and the environment.

In 2005, EPA placed a \$755,782 lien on that portion of the Zykan property where the removal actions were conducted. In May

2003, the Department completed a solid waste annual inspection at the Zykan Landfill, and a leachate outbreak was noted on the southern slope. The leachate outbreaks on the southern slope of the Zykan Landfill discharged into a tributary of Charrette Creek. A fair to good stand of vegetative cover exists on the landfill's caps and most slopes. The leachate outbreak was sampled October 2003, and the results indicated no contamination in the leachate.

EPA pursued the potential responsible parties on the BHS landfill (OU2) under a RCRA 7003 Order, dated January 2011. The draft order only covers only the BHS Landfill, as the potential responsible parties argued that they never placed any waste in the sanitary Zykan Landfill. The final order is not expected to be finalized for some time.

General Geologic and Hydrologic Setting:

The site is located in an upland setting in the watershed of a tributary to Charrette Creek. On-site soils are composed of 10 to 20 feet of loess overlying thick deposits of glacial drift. The upper 50 to 75 feet of drift is composed of till, which is characterized by dense, low permeability sandy and silty clay. This material is expected to provide an effective barrier to downward percolation of contaminants. Therefore, lateral leakage from the filled areas is the primary concern. Groundwater supplies within the glacial till are extremely limited. Natural conditions are well suited for preventing contamination of drinking water supplies.

Public Drinking Water Advisory:

St. Charles Co. PWSD #2 – Warren uses one active well located approximately 1 mile southwest of the landfill and one emergency well located approximately 2 miles south of the landfills. The well closest to the site is cased 567 feet, and the emergency well is cased 337 feet deep. Innsbrook uses two wells that are located approximately 2 miles southeast and 2 miles southwest of the site, with casings extending to depths of 550 feet and 475 feet, respectively. Maple Ridge MHP uses one active well located approximately 1.6 miles northeast of the site that is cased to approximately 502 feet deep, and Valley Lake Estates uses one active well located approximately 2.2 miles east of the site cased

to 572 feet deep. All of these wells draw water from the northern margin of the Ozark aquifer, which is not likely to be impacted from contamination related to this site due to relatively low permeability within the glacial till deposits that overlie bedrock in this region.

Health Assessment:

Contaminants of concern at this site include inorganics, organics, heavy metals, paints, pigments, pesticides, and ignitable waste with chlorobenzene, toluene, barium, 1,1-dichloroethane, naphthalene, manganese, and ammonia detected at levels above EPA Regional Screening Levels. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Missouri Department of Health and Senior Services historically conducted sampling of private drinking water wells in the area surrounding the BHS and Zykan Landfills. This surveillance revealed no drinking water contamination. The last round of sampling was conducted in November 2005. Department of Health and Senior Services identified two private wells in the direction of downgradient groundwater flow from the site. They considered these wells too far away to be impacted by site wastes because of the slow rate of groundwater movement. As a result, Department of Health and Senior Services has discontinued private well sampling in this area. However, sampling may begin again if more housing developments reach this area.

Based on available information, because the area is fenced, no current exposure to hazardous substances exists at the Zykan property. However, because of the site's historical leachate outbreak and unknown types and concentrations of hazardous substances possibly deposited in the three landfills, including a large amount of metal and debris located north of the landfills, a potential health risk must be presumed as the potential exists for contaminants to migrate into the environment. Department of Health and Senior Services suggests continued monitoring of the leachate outbreak area to ensure it is no longer occurring.

For more information regarding health-related issues, please contact the Missouri

Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

CLASS 3 SITES

ACME Battery



Name: ACME Battery

Classification: Class 3

Date of Registry Placement: December 19, 1996

Site Address: 3340 and 3344 Morganford Road, St. Louis, Mo.

Present Property Owners: Remains, Inc.

Lead Agency: Missouri Department of Natural Resources

Waste Type: Heavy metals (lead)

Quantity: Not determined

Site Description: The ACME Battery site was a former battery manufacturing plant that operated from 1963 until May 1997. The property is in a commercial/light industrial area in close proximity to residential areas. A September 1987 fire damaged much of the manufacturing and storage area and contaminated soils and debris with high levels of lead. The site is fenced, and Remains, Inc. occupies the north building (3340 Morganford). The remaining building is vacant.

Environmental Problems and Areas of Concern:

During a 1988 site inspection, EPA discovered high levels of total lead and leachable lead in soil. Between 1988 and 2001, multiple investigations by EPA, the Department, and ACME Battery documented total lead concentrations in soil ranging from 400 to 113,500 parts per million. The site is mostly capped with asphalt, but some uncapped areas remain. Water and soil at the site have exhibited very low pH (highly acidic).

Remedial Actions:

In 1993, ACME and EPA entered into an Administrative Order on Consent to address lead contamination. In 1994, ACME capped a portion of the site and agreed to place a deed restriction on the capped area and maintain the integrity of the cap.

In 1996, ACME took actions to prevent migration of contamination off its property in response to a complaint that lead was migrating to the adjacent International Foods property. These actions included installation of a retaining wall and application of limestone to prevent surface runoff from ACME to International Foods. ACME discontinued operations at the site in 1997, which involved cleaning and removal of equipment, capping

below-grade lines, and off-site disposal of remaining battery acid. AMCE removed and stockpiled two dumpsters worth of soil that failed the Toxicity Characteristic Leaching Procedure. Several notices of violation issued by the Department led to a suit filed against ACME Battery by the state of Missouri for failure to properly manage and dispose of this hazardous waste soil. The suit was settled in 2000. ACME hired Envirotech, Inc., to dispose of the hazardous waste. Afterwards, ACME gave Envirotech permission to use the north building for warehouse and office space.

In 2000, the St. Louis Development Corporation's (SLDC) Land Reutilization Authority took ownership of the site via a tax auction. Lead wipe samples taken at that time inside the north building (still occupied by Envirotech) contained lead at levels ranging from 64 to 29,635 times the residential screening levels. Because of this, Envirotech vacated the premises in 2001. SLDC enrolled the site in the Department's Brownfields/Voluntary Cleanup Program in 2003. In 2005, Remains, Inc. purchased the property from SLDC and continues the site's participation in the Brownfields/Voluntary Cleanup Program.

Activities conducted to date under Department oversight include repairs to and expansion of the asphalt cap, removal of contaminated soil, demolition, asbestos abatement, and reconstruction of the west side of the north building, decontamination of the entire north building, and removal of a heating oil underground storage tank. Remains, Inc. set up textile recycling operations in the east side of the north building after decontamination was completed in 2006, and will expand these operations to the west side now that it has been reconstructed.

In August 2010, the Department approved change of use requests for construction of a semi-permanent fabric-covered structure on the southeast end of the property to be used for textile storage. In September 2016, the Department approved another change of use request to expand the recycling operation in the east of the north building to the new west side. Remains, Inc. plans to address the remaining areas of uncapped soil and the south building (3344 Morganford) at a later date. On May 24, 2018, the Department completed the Fiscal Year 2018 Registry annual inspection. The inspection report noted the parking lot is capped and appeared to be

in good condition.

General Geologic and Hydrologic Setting:

The site is located on gently rolling uplands consisting of wind-blown loess, a soil that exhibits low to moderate permeability. A thin zone of residual clay soil, developed from the underlying bedrock, occurs at 20 to 30 feet below grade. Bedrock, composed of undifferentiated Pennsylvanian-age shale, coal, and sandstone, is present to a depth of about 60 feet below grade. Coal and clay were mined from the Pennsylvanian units. Thick sequences of Mississippian-age and older limestone formations occur at greater depths. Solution enlargement of bedding planes and joints is common in the limestone units.

Extensive grading produced a flat terrain, which tends to pond water, allowing infiltration through the surface soil. Infiltrated water could enter the artificially-created (mined) conduits within the uppermost bedrock, rapidly impacting the underlying aquifer.

Some low-yield wells in the St. Louis area produce potable water from the Mississippian bedrock aquifer. Water from underlying bedrock units is mineralized and is not used

Public Drinking Water Advisory:

The city of St. Louis uses the Missouri and Mississippi rivers as a primary source of public drinking water and no impacts are expected.

Health Assessment:

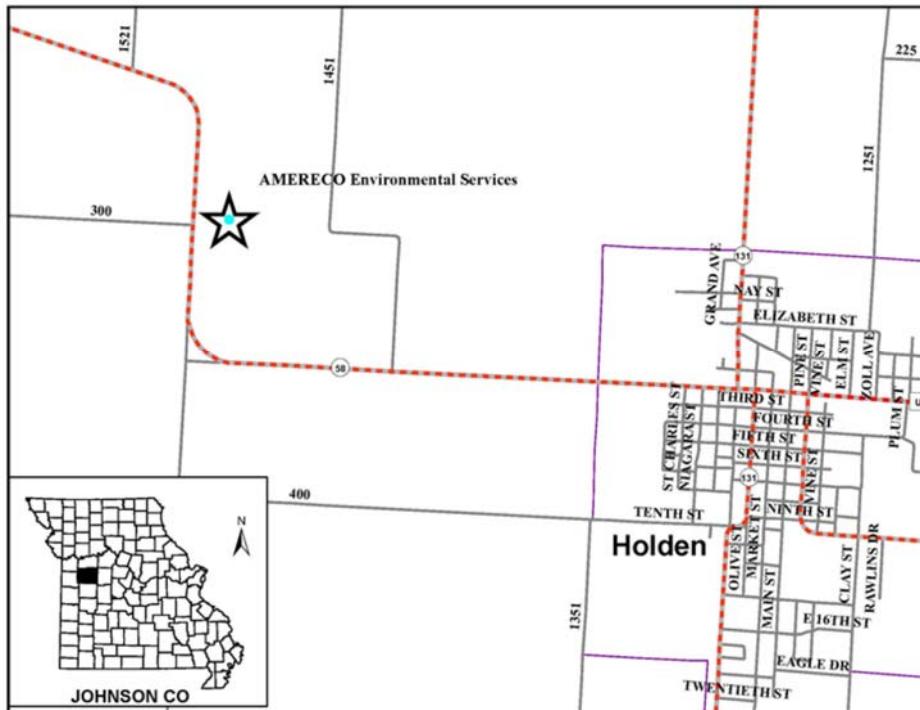
The contaminant of concern at this site is lead. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant. The primary health concern is human exposure from ingestion of lead-contaminated soil and inhalation of lead dust.

Based on available information, this site does not appear to pose a significant health risk to the public at this time. However, if site conditions were to change such that exposures to contaminated soils were to occur, adverse health effects may occur.

For more information regarding health-related issues, please contact the Missouri

Department of Health and Senior Services,
P.O. Box 570, Jefferson City, MO 65102, 573-
751-6102.

AMERECO Environmental Services



Site Name: AMERECO Environmental Services (West Star)

Classification: Class 3

Date of Registry Placement: September 10, 2003

Address: 1483 SW 58 Highway, Kingsville, Johnson County, Mo.

Present Property Owner: Jared Sisk

Lead Agency: Missouri Department of Natural Resources

Waste Type: Metals (cadmium, chromium, lead), polychlorinated biphenyls (PCBs), semi-volatile organic compounds (SVOCs), volatile organic compounds (VOCs)

Quantity: Not determined

Site Description: West Star Environmental (West Star) is a former hazardous waste treatment, storage, and disposal facility. The site has operated under various owners and has had multiple company names (i.e., PCB Disposal Systems; AMERECO Environmental Services (AMERECO); Essex Waste Management Facility; and West Star Environmental, Inc.). West Star is listed on the Registry Annual Report as AMERECO, but

within the site summary the last name the site operated under, West Star, is used. The facility accepted a variety of hazardous and non-hazardous waste from off-site sources for storage, treatment, and brokering to other facilities.

Johnson County acquired the West Star property from president and owner, Mr. William Kadri, in 2002, due to delinquent taxes on the property. Mr. Jared Sisk purchased the tax liability and the property on August 26, 2002, and took possession of the property in August 2004.

Although the West Star facility no longer operates, several buildings remain on site. The southern end of the largest building labeled RCRA2 contains several aboveground storage tanks located in a secondary containment structures.

Environmental Problems and Areas of Concern:

While hazardous waste does not appear to have been released from the site, remaining tanks and pipes have not been closed properly and may contain hazardous waste. Proper characterization, decontamination, and/or disposal of remaining material is required to ensure protection of public health

and the environment.

Remedial Action:

The site has a long and complex history of violations and corrective action under the Resource Conservation and Recovery Act program. Because of the continuing violations, the Department issued a Notice, Order to Close, and Permit Revocation to West Star on July 6, 2000. Although West Star appealed the Order, the Hazardous Waste Management Commission confirmed June 2002 that West Star must close according to the Order. West Star did not begin closure of the facility as directed by the commission. Consequently, the Department initiated actions to close the facility and remove waste. At the Department's request, various generators assumed responsibility for disposal of a portion of the waste remaining. In 2002, these generators had much of the remaining hazardous waste inventory in bulk or in drums transported to an appropriate and approved off-site Resource Conservation and Recovery Act facility for treatment and/or disposal. Due to the liquidation of the insurance company that provided the financial assurance instrument to ensure proper closure, waste unclaimed by generators remained on site.

The Department's enforcement section exhausted its means of waste removal and referred West Star to the Department's Superfund section for investigation December 18, 2002.

In December 2003, the Department requested assistance from EPA for aid in the removal of flammable waste from the site.

On May 10, 2004, EPA removed approximately 10,000 gallons of flammable liquid from the site. Waste sludge remained in the bottom of the tanks in RCRA2 because it could not be vacuumed for removal.

In 2006, Superfund initiated an integrated Preliminary Assessment/Site Inspection/ Removal Assessment investigation of the site. The primary objectives of the investigation included obtaining data to identify and characterize containerized waste; locate and identify potential sources of contamination; attempt to delineate the extent of the hazardous substances present in surface or subsurface soil and surface water at the site; and assess the threat to public health and the

environment. Groundwater samples collected from nearby drinking water wells were below all health-based benchmarks for VOCs, SVOCs, and metals. On-site surface and subsurface soil samples collected were also below health-based benchmarks for VOCs, SVOCs, PCBs, and metals. Surface water and sediment samples collected both on and off of the site did not show VOCs or SVOCs above health-based benchmarks. The Department's sampling detected cadmium and lead above some health-based benchmarks in sediment collected from West Pin Oak Creek and a tributary to the creek. The Preliminary Assessment/Site Inspection/Removal Assessment concluded that based on the current site conditions and available information, the site did not warrant further Comprehensive Environmental Response, Compensation, and Liability Act action. The Department currently is working with the site owner to complete final closure. On April 25, 2018, the Department completed the Fiscal Year 2018 Registry annual inspection. The property is in general disrepair. Tanks and other debris are still on site.

General Geologic and Hydrologic Setting:

The site is located within the unglaciated Osage Plains section of the Central Lowlands physiographic province. Topographically, the site is situated amid rolling hills of an upland setting to the Northeast of Kesterson Lake and along the north shore of West Pin Oak Creek.

About 20 feet of residual silty clay soils cover Pennsylvanian-age bedrock of the Marmaton Group. The Marmaton Group is made up of shaley-limestone, sandstone, and coal. Both the surficial material and underlying bedrock are considered to have a low hydraulic conductivity.

Shallow groundwater is present in the residual soils. However, yields and quality generally are low. The approximate location of the uppermost water table is at the contact between the fine-grained surficial materials and the shaley-limestone bedrock with a flow direction toward the northeast. Groundwater found in this unconfined water-bearing zone is not present in sufficient quantities for regular domestic use. Deeper wells drilled into upper Marmaton Group produce small amounts of mineralized potable water. Groundwater mineralization increases significantly with

depth. As a result, no local water wells draw water from wells drilled deeper than 650 feet below ground surface.

Public Drinking Water Advisory:

Johnson Co. PWSD #2 uses groundwater wells, but all wells are located in the eastern half of Johnson County. No impacts to public drinking water sources are expected.

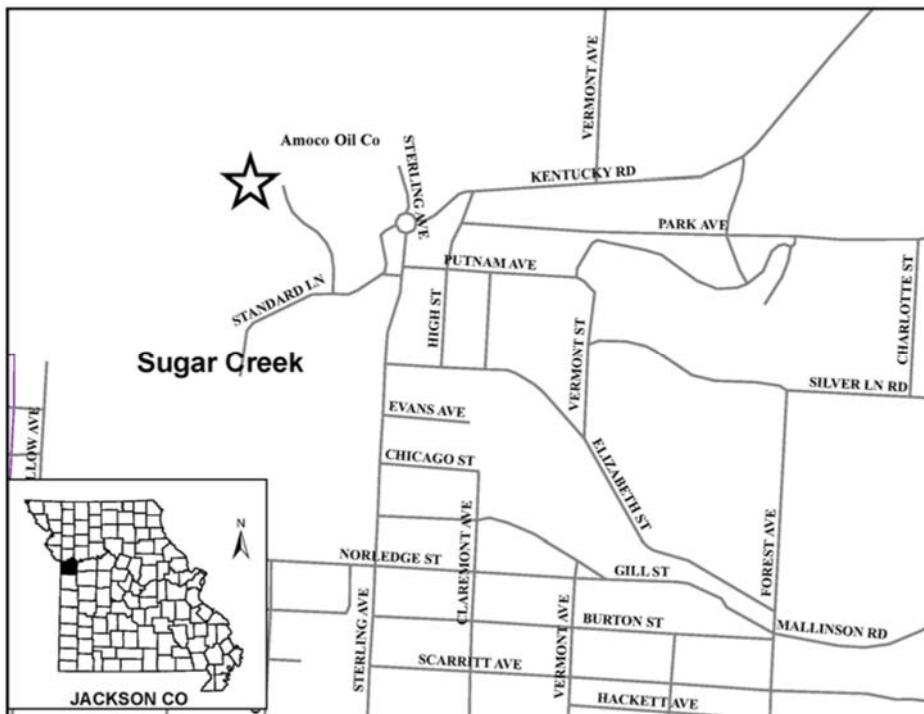
Health Assessment:

There is uncertainty associated with the types, volume, and instability of containerized hazardous waste that was being stored at this facility. Heavy metals such as arsenic, lead, cadmium, and mercury can cause a variety of health symptoms, including negative effects on every organ system. Eight metals along with 31 VOCs, such as benzene, 2-butanone, chloroform, tetrachloroethene, trichloroethene, and 11 SVOCs and PCBs were present in on-site containers at concentrations exceeding the toxicity characteristic leaching procedure regulatory limits for these compounds. See Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Based on available information, a health threat exists at this site. The site contaminants have not been fully characterized. The possibility of human exposure exists due to the marginally functional fencing, gates, and signs.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Amoco Oil-Sugar Creek Refinery



Site Name: Amoco Oil - Sugar Creek Refinery

Classification: Class 3

Date of Registry Placement: June 14, 1984

Site Address: 1000 North Sterling, Sugar Creek, Jackson County, Mo. Five areas contained in Sec. 28, W 1/2, Sec. 27, N 1/2, Sec. 33, R. 32W, T. 50N of the Independence Quadrangle and N 1/2, Sec. 28, R. 32W, T. 50N, NW 1/2 Sec. 27, R. 32W, T. 50N of the Liberty Quadrangle

Present Property Owner: BP Products North America, Inc.

Lead Agency: Missouri Department of Natural Resources (post closure and technical corrective action lead) and U.S. Environmental Protection Agency (administrative corrective action)

Waste Type: Lead and lead compounds, cadmium, polycyclic aromatic hydrocarbons, oil and sludges, chromium, arsenic, mercury, benzene, toluene, ethyl benzene, MTBE, and xylene

Quantity: Not determined

Site Description: This site is the location of a former oil refinery. The Amoco Oil Refinery began operations in 1904 and ceased refinement of crude oil and production of petroleum products in 1982. The former refinery area consists of about 423 acres. Buckeye Partners LLC operates a petroleum pipeline terminal on a portion of the property. The city of Sugar Creek police and fire station also is located on a portion of the property. The remainder of the property is fenced, locked, and guarded.

Five separate disposal areas, totaling approximately 22 acres of the Amoco property, are listed on the *Registry*. These areas are located next to the Missouri River. The registered areas include four inactive tank bottom disposal areas and one inactive sludge disposal area.

EPA identified a land farm for the disposal of leaded gasoline storage sludge as having high concentrations of lead and chromium. The land farm is near the river.

Environmental Problems and Areas of Concern:

The location next to the Missouri River presents problems because of flooding and groundwater contamination. The principal

discharge areas for groundwater beneath the site are the Missouri River and Sugar Creek. During the 1993 Flood, the inactive sludge disposal area was covered by floodwater.

Groundwater contamination is a result of historical site activities. Groundwater discharge to the Missouri River has had minor impacts to the water quality. The Missouri River and its alluvium are used as a drinking water supplies downstream, including for a major municipality.

Remedial Actions:

In the 1970s, Amoco Oil Company, now BP Products North America Inc., began groundwater monitoring at the site. In 1981, Amoco began Resource Conservation and Recovery Act quarterly groundwater monitoring. Amoco developed and submitted a revised closure plan for Resource Conservation and Recovery Act interim status units at the facility. These units are not part of the property that is listed on the *Registry*. In 1986, Amoco completed dismantling of process equipment, pipes, and tanks. In September 1987, the Department approved the closure plan for the surface impoundments. In April 1988, Amoco closed the RCRA leaded tank bottom area.

In 1999, Amoco completed bioremediation of the Single Waste Management Unit and began capping the treated soil. In August 1999, Amoco completed capping and closure activities.

On June 30, 1989, EPA issued Amoco a consent order. EPA's consent order required Amoco to conduct a RCRA Facility Investigation to investigate and characterize the entire site, conduct a Corrective Measures Study to evaluate remedy alternatives, and select a final remedy for the entire site.

In 2000, Amoco, EPA, and the Department agreed to divide the site into areas to speed up work on priority areas. Amoco submitted RCRA Facility Investigation (RFI) Reports and Corrective Measures Studies for one off-site area (Norledge) and nine on-site areas (Crawford and Sugar Creek Areas) to the Department and EPA for review and approval. On April 6, 2005, the Department issued Amoco a Corrective Action Abatement Order on Consent. Once the final remedy for each area is approved under EPA's order, the

Department's order covers the implementation of the final remedy for that area.

On November 30, 2006, EPA and the Department approved the final remedy for the off-site area (Norledge). On May 12, 2008 the final remedy for two of the on-site areas (Crawford and Sugar Creek) was approved. In 2015, EPA and the Department approved the RFI reports for the remaining on-site areas. In the same year, Amoco, EPA, and the Department decided to recombine the remaining areas for selection of a final remedy. In August 2016, Amoco submitted a draft consolidated final remedy proposal. The draft consolidated final proposed remedies for all remaining areas and revises the existing remedies for the on-site areas. The draft consolidated remedy proposal is under review by the Department and EPA.

Amoco implemented numerous interim measures to remove contamination throughout the site, including soil and product removal, multiphase extraction wells, horizontal extraction wells, interceptor trenches, vacuum truck recovery, passive skimming systems, and hydraulic control systems. The Fiscal Year 2018 annual inspection was completed by the Department on April 25, 2018. It was noted that the site was well vegetated, fenced, gated and locked, as well as patrolled.

General Geologic and Hydrologic Setting:

The site is near the junction of Sugar Creek and the Missouri River. The former plant is located on an upland while the disposal facilities are located in the flood plain.

Pennsylvanian-age limestone and shale bedrock is present in the upland area south of the river. Most of this area is covered by varying thicknesses of silty clay loess and weathered loess. The disposal facilities for the plant are situated on fill and alluvial soil of the Missouri River flood plain.

The bedrock underlying surficial material is considered to be of low permeability. Movement of contaminants is therefore most likely to occur through highly permeable alluvium in the valley and, to a lesser extent, through the loess.

Potential contaminants from the uplands are expected to move downgradient to the north,

emerging at the flood plain. Contamination from the flood plain may move through the shallow alluvial material directly to the Missouri River.

Public Drinking Water Advisory:

The city of Independence's well field is located approx. 2.5 miles downstream of this site, and the nearest surface water intake is located in Lexington, Mo., approximately 38 river-miles downstream. Although Independence draws water from shallow Missouri River alluvium, no impacts are expected related to this site.

Health Assessment:

Chemicals of concern at this site include lead, chromium, phenol, arsenic, mercury, benzene, toluene, and tetraethyl lead as being found in water samples. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

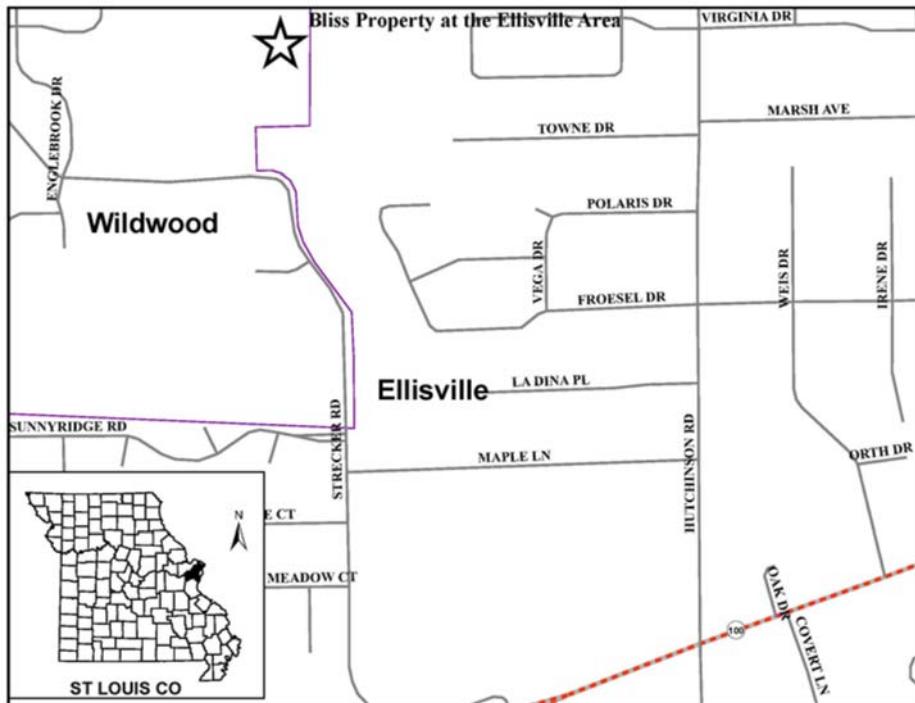
Contaminated groundwater is the major pathway of concern at this site. The average slope is less than two percent, which makes surface runoff unlikely, except when the Missouri River floods the area. Because the facility is isolated and access is restricted, direct contact and inhalation are not considered to currently pose a public health threat.

An exposure assessment conducted by the Missouri Department of Health and Senior Services uncovered no evidence of human exposure occurring off site. The nearest public drinking water wells are approximately three miles downstream. The site could adversely affect water quality of both the Missouri River and the alluvial aquifer.

Although no exposure is currently occurring, based on the toxicity of the chemicals present and the known groundwater contamination, this site continues to pose a potential health threat.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Bliss Property — Ellisville



Site Name: Bliss Property – Ellisville

Classification: Class 3

Date of Registry Placement: January 3, 1984

Date of National Priorities List Listing:
September 8, 1983

Site Address: 149 Strecker Road, Ellisville, St. Louis County, Mo.
Portions of SW 1/4, NW 1/4, Sec. 32, T. 45N, R. 4E, Manchester Quadrangle

Present Property Owner: Jerry Russell Bliss et al.

Lead Agency: U.S. Environmental Protective Agency (EPA)

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), waste pigments, solvents, oils, and pesticides

Contaminants: TCDD, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals

Quantity: In 1996, EPA completed a Removal Action and removed a total of 24,478 tons of TCDD-contaminated soil, 581 tons of non-TCDD-contaminated soil, and 480 buried

drums and other containers of waste. EPA completed a subsequent Removal Action in 2015, resulting in 1,545 tons of TCDD-contaminated soil being removed from the site.

Site Description: This site consists of approximately 16 acres in western St. Louis County located on the north side of Strecker Road. The "Bliss – Ellisville Superfund Site" consists of the 11.56-acre Bliss property located on Strecker Road and parts of several contiguous properties. The area on the Registry includes the 11.56-acre Bliss property, a 1-acre east bounding parcel along Strecker Road, and 3.465 acres of the northwest bounding 4.29-acre parcel (formerly referred to as Simmons property).

The Bliss property currently is used as a personal residence and a commercial horse boarding and arena operation, the 1-acre property contains a residence, and the northwest parcel is a vacant grass and wooded area; all are owned by at least Mr. Bliss. Two intermittent unnamed streams flow through the site; one flows northward, roughly parallel to and on the east side of the entrance road, into the second stream, which flows to the northwest through the northwest parcel. The site is located in an upland wooded area and is surrounded by numerous new housing developments with residences within 2,000

feet of formerly contaminated areas. A number of schools and homes for the aged are located within 0.5 mile.

During the 1960s and 1970s, Bliss Waste Oil Company operated at this site. The business engaged in transportation, disposal, and recycling of waste oil products, industrial wastes and chemicals.

Investigations identified soil contamination resulting from the disposal of TCDD-contaminated waste from the waste oil hauling business. Bliss Waste Oil Company disposed of other hazardous wastes, such as solvents, pesticides, and oils in bulk quantities at the site. In 1983, the site was added to EPA's National Priorities List.

Environmental Problems and Areas of Concern:

Following excavation of contaminated soil, buried drums, and other containers of waste, shallow groundwater monitoring performed on site by EPA, between 1997 and 2003, documented elevated levels of VOCs, SVOCs, metals, and TCDD. A number of the contaminants exceeded their maximum contaminant levels. EPA found low level detections of organic compounds at an off-site spring, Lewis Spring, which suggested the possibility of contaminant migration from the site. The Department continued sampling of on-site groundwater and the spring from 2006 through 2016 and is evaluating the data.

Remedial Actions:

In the 1980s, the Department conducted a number of investigations at the site that confirmed the reported presence of hazardous materials in drums and disposal pits and delineated the approximate boundaries of actual or suspected waste disposal locations. In 1983, EPA completed a Remedial Investigation, which identified the following hazardous waste problems: buried drums, tanks, and other debris; buried containerized hazardous wastes; contaminated soils and sediments; and soils and dust contaminated with TCDD.

In April 1986, the Department erected 400 feet of fence to prevent access to the site from the newly-developed Quail Woods Park. EPA issued a Record of Decision for the management of the non-TCDD-contaminated

soils September 1986. The Record of Decision proposed excavation and off-site disposal as the preferred remedy for the buried drums and buried uncontaminated hazardous waste. The Record of Decision included an interim remedy for TCDD wastes, which involved excavation of the contaminated soils and temporary on-site storage awaiting final management. The Record of Decision included operation and maintenance activities to ensure continued effectiveness of the on-site interim storage facility, including maintenance of the security system, maintenance of site run on/runoff controls, leachate sampling and analysis if necessary, and groundwater monitoring.

In September 1988, EPA issued a Record of Decision for Final Management of Dioxin-Contaminated Soil and Final Disposition of Structures and Debris at Times Beach, Missouri and the Minker/Stout/Romain Creek Site, Missouri, which established that the TCDD-contaminated soils from a group of designated eastern Missouri sites, including the Bliss-Ellisville site, could be transported to Times Beach for thermal treatment (incineration). In November 1993 and August 1994, EPA collected surface soil and sediment samples from the drainage way and adjacent areas located between the site and the Turnberry Place Subdivision located north (downgradient) of the site to determine whether severe flooding during the summer of 1993 caused migration of TCDD-contaminated materials off site. The samples did not detect TCDD.

In 1996, EPA and certain potentially responsible parties implemented a Removal Action at the Bliss-Ellisville site comprising the following activities. TCDD-contaminated soil was removed according to the approved health-based action levels of one part per billion equivalent level at the surface and 10 parts per billion at a depth of 12 inches, except fill areas where the action level was 1 part per billion at all depths. In the creek, the TCDD action levels were 1 part per billion to 2 feet; depths greater than 2 feet were cleaned up to 10 parts per billion. Excavated TCDD-contaminated material was transported to Times Beach for thermal treatment. Off-site commercial Resource Conservation and Recovery Act permitted hazardous waste facilities managed the non-TCDD hazardous wastes. In all, 24,478 tons of TCDD-contaminated soil, 581 tons of non-TCDD-

contaminated soil, and 480 buried drums and other containers of wastes were removed from the site. Soil samples were collected to confirm that cleanup goals had been achieved. Once cleanup activities had been completed, excavated areas were backfilled, re-graded, and seeded.

During fall 1997, EPA installed three shallow groundwater monitoring wells at the site to determine if any of the contaminants migrated into the local groundwater. EPA sampled the wells on a quarterly basis from 1997 through 1999, and 2002 through 2003. EPA also sampled Lewis Spring, located about 2.5 miles from the site, to determine if any possible contamination migrated from the site. In June 2006, EPA prepared a summary report of analytical data collected by EPA and the Missouri Department of Health and Senior Services from 1997 through 2006 from the on-site monitoring wells, off-site private wells, and the off-site spring. Several metals and organic compounds exceeded health-based benchmarks in monitoring wells.

Trichloroethene was detected in one private well in 1985 but not in subsequent samples from that well or in any other downgradient wells. Low-level detections of organic compounds were reported in Lewis Spring samples.

The Department conducted several rounds of groundwater sampling at the site and Lewis Spring from 2006 through 2016. During this time, the Department installed four additional groundwater monitoring wells at the site, which were included in the sampling events. The Department also conducted several rounds of soil gas sampling from 2009 through 2016 at three locations between the site and the nearest residences of the Turnberry Place Subdivision to evaluate the potential for vapor intrusion to affect homes in the area. In 2011, the Department installed three soil gas monitoring wells as part of the investigation. In September 2008, the Department performed sampling of subsurface soils on the Bliss property. The purpose of the sampling was to investigate the overburden soils to identify source material, if present, that could be contributing to the groundwater contamination beneath the Bliss property and decide whether further investigation or action is warranted. All samples were analyzed for VOCs, SVOCs, and metals. Three samples were additionally analyzed for TCDD and furans. The Department is compiling and

evaluating results of its groundwater monitoring well, soil gas, subsurface soil, and spring sampling events performed at the site from 2006 through 2016. This data review will be documented in a report and will determine future site activities, if needed.

Following a series of investigations in 2014, EPA conducted a Removal Action on an approximately 1-acre area encompassing the northwest portion of the Bliss property and a portion of the west-bounding Strecker Forest property. During these investigations, 1,545 tons of TCDD-contaminated soil were removed and appropriately disposed. Two environmental covenants establishing land use restrictions for these areas were executed March 2015 and are on file with the St. Louis County Recorder of Deeds. The restrictions include no occupied residential land use (residential subdivision preservation or common area is acceptable) and no disturbance of soil without Department permission.

General Geologic and Hydrologic Setting:

The site is located in an upland wooded area with steep hillslopes descending to a low-lying, intermittent tributary of Caulks Creek. The upland soils are composed of silty clay loess overlying cherty residuum derived from the weathering of bedrock. The loess is up to 10 feet thick and has moderate to low permeability. The residuum is moderately to highly permeable. Soil material along the valley, near the horse arena, is composed of gray, silty clay and clayey silt.

Bedrock at the site consists of the Mississippian-age Burlington Limestone Formation. This formation contains solution-enlarged openings, which provide avenues of rapid fluid transport to groundwater.

Under normal flow conditions, the surface drainage upstream of the former dump site area is gaining; that is, water flowing on the surface tends to remain on the surface. This is due to the presence of the relatively low-permeability loess soil which underlies that portion of the property. However, in the vicinity of the former dump site where the loess is absent, surface water is lost to the subsurface via the relatively high-permeability cherty residuum and weathered bedrock present beneath that portion of the site. Water tracing studies conducted in 1992 and 1997 indicate

that water flowing into the subsurface in the vicinity of the former dump site is discharged at Lewis Spring, which is located along Caulks Creek downstream of the site. During high surface flow conditions (i.e., immediately following heavy precipitation events) some flow remains in the surface stream throughout its extent on site and further downstream.

Due to the presence of losing stream conditions immediately downgradient of the former dump site, groundwater quality may be adversely impacted. However, subsurface flow from the losing stream segment probably is channelized sufficiently to prevent widespread contamination of groundwater.

Public Drinking Water Advisory:

No public water sources are located in the immediate vicinity of this site. A small business uses an active public water well approximately two miles west-southwest of the site, but groundwater generally flows north towards the Missouri River. Based on this information, no impacts to public water sources are expected.

Health Assessment:

TCDD is the main chemical of concern at this site. VOCs have also been detected in the on-site monitoring wells. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

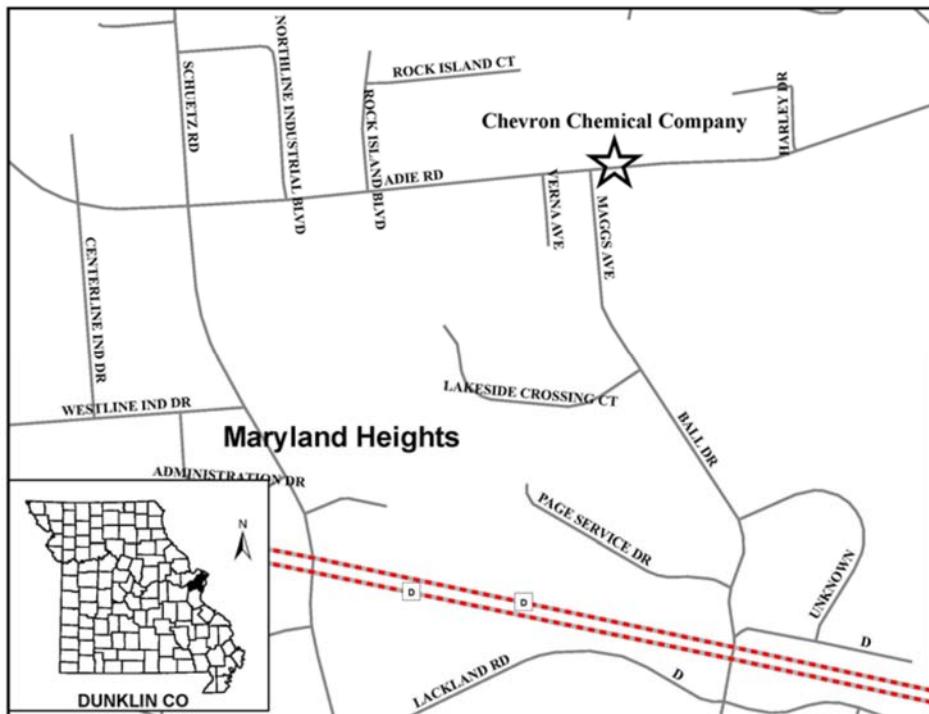
Shallow groundwater is contaminated with VOCs; therefore, the route of potential exposure that remains is through groundwater. Missouri Department of Health and Senior Services sampled private wells downgradient from the site from 1984 to 2013 and have not found any private wells contaminated with site-related VOCs.

Based on available information, this site poses a potential health risk due to contaminated groundwater. Potential for vapor intrusion is still being investigated.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Site Name: Chillicothe FMGP

Chevron Chemical Company



Site Name: Chevron Chemical Company

Classification: Class 4

Date of Registry Placement: January 6, 1984

Site Address: 2497 Adie Road, Maryland Heights, St. Louis County, Mo

Present Property Owner: Chevron Chemical Company

Lead Agency: Missouri Department of Natural Resources

Waste Type: Organochlorine pesticides and herbicides, carbamate fungicides, volatile organic compounds (VOCs), and arsenic

Quantity: Not determined

Site Description:

The site is a former pesticide and fertilizer formulation plant operated by the Ortho-Chevron Chemical Company between 1948 and 1994. Waste burial, spills, and leaks at the plant have contributed to subsurface contamination. The site is located in a light commercial/industrial corridor of Maryland Heights, bordering a residential area with a

population of fewer than 25 within a 0.5-mile radius. The site is fenced and gated.

Following a fire at the facility in 1952, Chevron buried debris and a variety of chemicals, including organochlorine pesticide and herbicide products, in unlined pits on the property. Additionally, the company buried up to 2,000 pounds of the carbamate fungicide Maneb and arsenic-containing wastes on the property between 1957 and 1970. Chevron subsequently constructed buildings over a portion of the burial area. The entire property currently is paved or covered with buildings. Some of the buildings remaining at the property are leased to several businesses as warehouse and office space.

Environmental Problems and Areas of Concern:

Between 1981 and 1994 Chevron consultants conducted a series of investigations. These investigations identified organochlorine pesticides and herbicides, arsenic, and various VOCs in on-site soil and shallow groundwater. Maximum organochlorine pesticide concentrations of over 7,000 parts per million and arsenic concentrations over 1,000 parts per million have been measured in the soil. Organochlorine pesticide/herbicide and arsenic levels in groundwater beneath the

site have been measured as high as 6,480 parts per billion and 66,000 parts per billion respectively. Maximum volatile organic compound concentrations in groundwater include trichloroethene (TCE) at 9,470 parts per billion, xylenes at 28,600 parts per billion, and chlorobenzene at 1,200 parts per billion. Groundwater occurs less than 10 feet below ground surface in some areas of the site. The gradient is generally toward the northeast; however, there appears to also be a southerly component of flow along the southwestern portion of the property. Groundwater monitoring indicates that organochlorine pesticides and herbicides, arsenic, and VOCs, including trichloroethene, have migrated in groundwater off site to the north, south, and west.

Remedial Actions at Site:

Following the site's placement on the Registry, Chevron consultants conducted several site characterization investigations in the 1980s and early 1990s. Soil samples have been collected from multiple depths at 56 boring locations on the Chevron parcel and some adjacent parcels. Groundwater monitoring began at the site in 1981. Currently, 29 bedrock monitoring wells are associated with the site, including several located off of the Chevron property.

The EPA and Chevron entered an Administrative Consent Agreement and Consent Order in 1987. Under EPA oversight, Chevron capped unpaved areas of soil contamination north of the buildings, and installed a storm water collection and detention system in 1992. When manufacturing operations ceased at the facility in 1994, Chevron removed pesticide-handling equipment and storage containers and decontaminated building surfaces under EPA oversight. The property is now fully covered by asphalt, concrete, or building structures. Some of the buildings are leased to various commercial interests.

In 1990, the Missouri Department of Health and Senior Services conducted a health assessment, which concluded that the site posed a low risk to public health as long as direct exposure to the subsurface contaminants was controlled. EPA referred lead oversight to the Missouri Department of Natural Resources in 2008, recommending that Chevron continue to monitor groundwater annually. Currently, 16 of the 29 monitoring

wells are included in an ongoing annual monitoring program. Groundwater is monitored for organochlorine pesticides, arsenic, and VOCs.

Over time, groundwater contaminant concentrations have decreased at many of the wells. However, increases in organochlorine pesticides and volatile organic compounds have been observed at downgradient well locations to the north, northwest, and south. Of particular concern is TCE, due to the potential for vapor intrusion; levels of TCE have increased from a maximum of 2,000 parts per billion when first measured in 1991 to 8,100 parts per billion in 2017.

Due to uncertainty about the source of the TCE groundwater contamination and concerns about potential vapor intrusion, the Department conducted a Pre-Comprehensive Environmental Response, Compensation, and Liability Act Screening investigation in 2014 under the site name Maryland Heights TCE Site. The investigation included an assessment of other nearby known sources of TCE contamination and sampling at existing monitoring wells on a property 0.5 mile southeast of the site. No upgradient TCE sources were identified. Following the investigation, the Department initiated a Comprehensive Environmental Response, Compensation, and Liability Act Site Inspection in 2016 to further investigate TCE contamination at the Maryland Heights TCE Site. The Site Inspection is expected to be completed in late 2018.

General Geologic and Hydrologic Setting:

The site is underlain by 20 to 30 feet of loess, or wind-deposited, clayey silt, over Pennsylvanian shale or residual clay. A limestone unit that is part of the uppermost aquifer lies below the shale or clay at a depth of about 30 to 70 feet.

The confining unit at the base of this aquifer is the Maquoketa Shale at a depth of several hundred feet. Water from deeper horizons of the limestone aquifer may be too saline to be considered potable. The shallow part of the bedrock aquifer probably produces good-quality water; however, yields may be low. Groundwater is not used widely in this area due to the presence of public surface water supplies.

Perched water is present in the loess, but

yields are so low that this is not considered an aquifer. The perched groundwater has been affected by contaminants at the site. Due to the presence of low-permeability material beneath the loess, the water within the loess is expected to discharge to the surface or to buried sewer lines downgradient of the site.

The site is located in the Fee Fee Creek watershed. Surface water from the site is collected in an on-site lined detention pond, which discharges through the city storm water system into Fee Fee Creek. Fee Fee Creek ultimately drains into the Missouri River approximately 5 miles northwest of the site.

Public Drinking Water Advisory:

This region is served drinking water by Missouri American Water – St. Louis Co./St. Charles Co., which draws water from the Missouri and Meramec rivers. No site-related impacts are expected.

Health Assessment:

The primary contaminants of concern at the site are: arsenic, various organochlorine pesticides and herbicides including aldrin, 2,4-dichlorophenoxyacetic acid, dieldrin, lindane, chlordane 4,4'-dichlorodiphenyltrichloroethane, and toxaphene, and VOCs including TCE, chlorobenzene, and xylenes. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

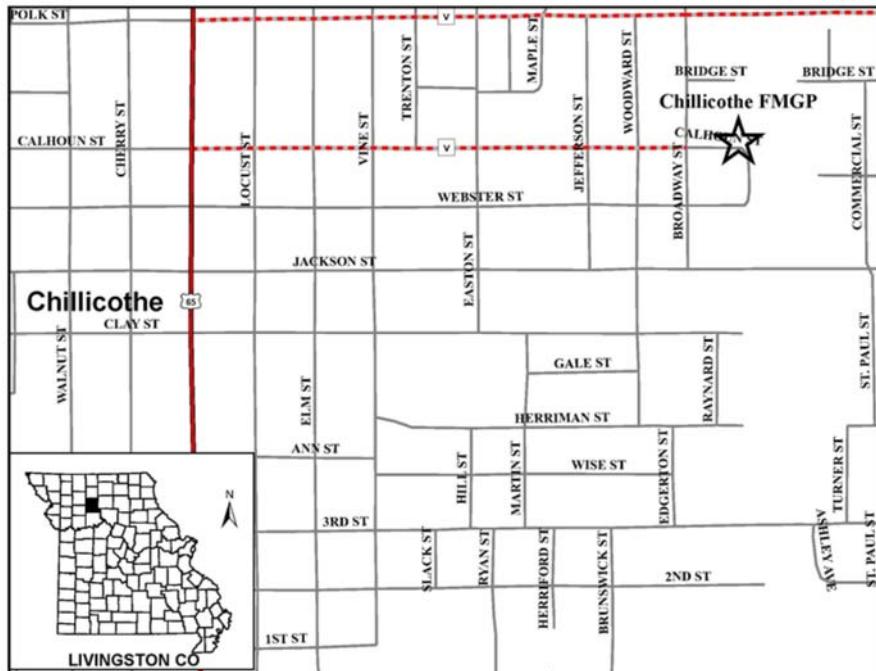
Because contaminated areas have been capped and paved, potential human exposure is limited. The potential for human contact with the on-site contaminated soil is further reduced because the site is fenced, secured, and covered by asphalt, concrete, and buildings. Because the site areas are capped and paved, the potential for exposure from airborne contaminants and surface water is expected to be low.

Due to off-site migration and the potential for vapor intrusion to occur, the Missouri Department of Health and Senior Services recommends continuing the ongoing Site Inspection of the Maryland Heights TCE site to further evaluate the extent of TCE contamination and assess the potential for exposure through the vapor intrusion pathway.

Based on available information, this site poses a possible health risk, primarily through the vapor intrusion pathway. Maintaining the existing asphalt cap will eliminate potential direct exposure to contaminated soils. If site conditions change such that exposure to contaminated soil occurs, adverse health effects could occur.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Chillicothe FMGP



Classification: Class 3

Date of Registry Placement: April 8, 2000

Site Address: Between Calhoun and Bridge Streets, Chillicothe, Livingston County, Mo., NW ¼, NW ¼, SE ¼, Sec. 36, T. 58N, R. 24W, Chillicothe Quadrangle

Present Property Owner: Empire District Gas Co.

Lead Agency: Missouri Department of Natural Resources

Waste Type: Coal tar, which contains volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs)

Quantity: Not determined

Site Description: The Chillicothe Former Manufactured Gas Plant site is 0.63 acres in size and located in an industrial area next to residential areas within the city of Chillicothe. A manufactured gas plant operated at the site from 1892 until 1939. Some structures from the past gas manufacturing facility might still be partially intact beneath the site. A chain-link fence topped with barbed wire has been installed around the site. The site currently is used as a service center for natural gas

distribution in the Chillicothe area. It contains a metal warehouse used as an office and for storage of parts and equipment. The rest of the site is mostly a storage yard. The surface of the storage yard has been paved using cast-in-place concrete.

The plant first produced oil gas, then changed to water gas in 1913. After the plant stopped manufacturing gas, liquefied petroleum gas was stored at the site for distribution to the city. Estimated total production during the plant's 47 years of operation is 324,000,000 cubic feet of gas and 270,000 gallons of coal tar. Coal tar, a byproduct of the gas manufacturing process, is the primary waste of concern.

Environmental Problems and Areas of Concern:

Carcinogenic PAHs were present in the surface soil and in one residential yard adjacent to the site. Coal tar containing PAHs and VOCs were detected at concentrations above regulatory limits in the subsurface on site. Specifically, benzene was present at a concentration above the Toxicity Characteristic Leaching Procedure regulatory limit of 0.5 part per million. One sample had a Toxicity Characteristic Leaching Procedure result of 7.8 part per million.

Remedial Actions:

Around 1940, all manufactured gas equipment was removed from the site. In 1983, approximately 28,000 gallons of ignitable coal tar gas waste was removed from the site and transported to an incinerator. The Department completed an Integrated Site Inspection/Removal Site Evaluation March 26, 1999, and concluded that the surface soil contamination was not a concern at this time. The coal tar remaining in the subsurface did not pose an exposure risk; however, it will continue to be a threat should excavation occur in the future. The Integrated Site Inspection/Removal Site Evaluation also determined no known drinking water wells were located within a one-mile radius of the site.

In 2007, as part of a service building expansion, Empire District Gas Co. (Empire) removed 168 tons of soil and 2,200 gallons of groundwater from the site and encapsulated the area surrounding the building with a concrete cap. On May 9, 2017, Empire collected three drinking water samples; two samples from inside the building and one off-site sample from the Chillicothe public water system. The samples were analyzed for VOCs, SVOCS, and the Resource Conservation and Recovery Act metals. No VOCS or SVOCS associated with former manufactured gas plant were detected. One metal was detected, barium, at 21, 20, and 22 parts per billion. No maximum contaminant limit exists for barium; however, these results are well below the secondary drinking water standard of 2,000 parts per billion for barium.

Empire submitted a work plan dated March 22, 2018, to remove and replace an old circular concrete pad that was part of the former manufactured gas plant operations. Excavation and removal activities are planned for some time in July 2018.

General Geologic and Hydrologic Setting:

The Chillicothe Former Manufactured Gas Plant site is located in the Dissected Till Plains region of the Central Lowlands Physiographic Province. The area is blanketed by a layer of low-permeability glacial till, consisting of a poorly-sorted mixture of clay- to boulder-sized particles. A thin mantle of windblown loess covers the till. The thickness of unconsolidated deposits ranges from 0 to 180 feet in the area.

Pennsylvanian-aged bedrock, consisting of shale, limestone, and sandstone, underlies the unconsolidated material.

An east-west trending preglacial channel located just south of Chillicothe is the primary source of drinking water in the area. Minor amounts of poor quality groundwater can be found in glaciofluvial sand and gravel lenses in the till. Yields from wells outside the preglacial channel are usually low. Pre-glacial channel wells can have substantial yields.

Water from the consolidated bedrock is mineralized, which increases with depth. It appears that in the early part of the century, the bedrock was commonly used as a source of groundwater, but all recent wells draw water from the unconsolidated sediments.

Public Drinking Water Advisory:

The city of Chillicothe uses several wells that draw from unconsolidated pre-glacial river channels. Four wells are located approximately 1.5 miles south-southwest of the site. The thickness of pre-glacial deposits is loosely constrained, but a transition between deposits less than 100 feet thick and those greater than 100 feet appears to trend roughly east-west between this site and the city's well field (situated in the thicker portion of the pre-glacial deposits). The possibility of groundwater flowing from the thinner deposits southward into the deeper and thicker deposits does exist, but no impacts to the city's wells are recognized. The specific subsurface flow of groundwater, again, is loosely constrained, and site-related contamination may not be migrating towards the city's wells. Although no impacts from this site are expected, any detections or increased concentrations of contaminants identified through routine monitoring of the wells would warrant additional scrutiny of potential pathways from the site to the city's well field.

Health Assessment:

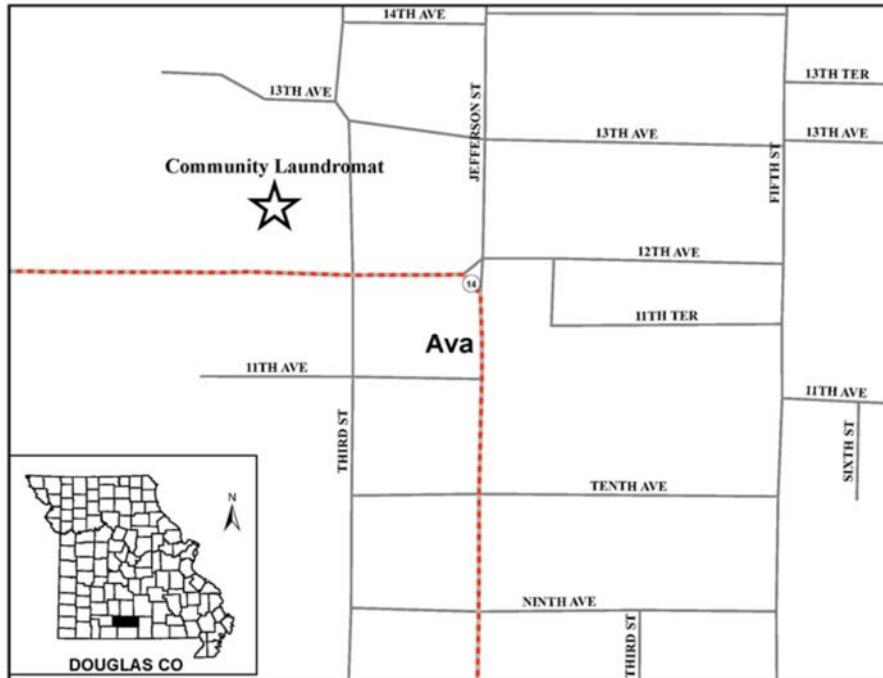
The following are the major contaminants of concern found in soil at the site: benzene, ethylbenzene, cadmium, toluene, xylene, and PAHs. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Because the site is capped, subsurface soil is not readily accessible. Risk associated with this site to nearby residents and persons accessing the site appears to be limited to potential vapor intrusion and migration of subsurface contamination into groundwater. If the cap does not remain intact, contaminants within subsurface soils may then be either taken in through ingestion or dermal contact with contaminated soil, and inhalation of dust and vapors.

Based on available information, this site represents a potential health threat. Currently, workers occupying the additional building may be at risk due to vapor intrusion into the building. Residents off site may also be at risk due to the limited characterization of contamination.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Community Laundromat



Site Name: Community Laundromat

Classification: Class 3

Date of Registry Placement: March 21, 2003

Site Address: 306 NW 12th Ave., Ava,
Douglas County, Mo.

Present Property Owner: John Sutton

Lead Agency: U.S. Environmental Protection
Agency (EPA)

Primary Waste Type: Tetrachloroethene
(PCE) and degradation products
trichloroethene (TCE) and cis-1,2-
dichloroethene (cis-1,2-DCE)

Quantity: Not determined

Site Description: The site consists of the former location of the Community Laundromat facility and a groundwater plume beneath the property. The contaminant plume extends at least 0.5 mile to the southwest. Mr. Joe Banta opened the laundromat in 1986 and provided dry cleaning services using tetrachloroethene during the late 1980s and early 1990s. In 2004, operations ceased when Mr. John Sutton purchased the property. In 2007, the building was demolished by Mr. Sutton. The remainder of the property is unpaved and

vacant with unrestricted access. Land use in the area is a mix of commercial, light industrial, agricultural, and residential.

Environmental Problems and Areas of Concern:

Based on Missouri Department of Natural Resources and EPA investigations to date, only PCE and TCE have been detected in the on-site soils and/or groundwater; however, cis-1,2-DCE has been detected in a downgradient spring.

Remedial Action:

The Community Laundromat site was determined to be one of multiple sources of volatile organic compounds associated with the 12th Avenue Solvents site, a site adjacent to the Community Laundromat site. In January 2002, a treatment system was installed by the responsible party for the 12th Avenue Solvents site that also treated volatile organic compounds (VOCs) and the PCE and its degradation products from the Community Laundromat site.

Investigations conducted by EPA, the Department, and multiple potential responsible parties from 2001 to 2007 determined the Community Laundromat site to be a source of PCE and its degradation

products. In 2007, the EPA found high concentrations of PCE in subsurface soil below the footprint of the former building slab.

In 2016, EPA conducted additional investigations of on-site soil and off-site groundwater, along with vapor intrusion testing of several residences and businesses near the site. Several VOCs were detected in ambient outdoor and indoor air samples; PCE was detected below acceptable indoor air levels ($2 \mu\text{g}/\text{m}^3$) or not detected. PCE was detected in on-site groundwater exceeding the acceptable water quality standard. Analytical results from five subsurface soil locations detected PCE above the soil threshold protective of groundwater. Of two surface water samples collected off site, one sample exceeded the water quality standard for PCE.

The 12th Avenue Solvents treatment system is no longer required to operate as part of the 12th Avenue Solvents site's remedial action. Planned removal actions for the Community Laundromat site include continued operation of the 12th Avenue Solvents site treatment system until October 2018 and excavation of the PCE soil source at the site to inhibit further migration of chlorinated compounds in groundwater. Excavation is expected to occur in August 2018 and be completed in September 2018. The Community Laundromat property is currently a parking lot.

General Geologic and Hydrologic Setting:

The site is located in the Salem Plateau section of the Ozark Plateaus physiographic province.

Soils are composed of gravelly clays and sandy loams developed from Ordovician-age Jefferson City Dolomite. Soil thickness varies from 8 to 20 feet from north to south across the site. The Jefferson City Dolomite, about 180 feet thick, is composed of interbedded dolomite, sandstone, and shale, with less than five percent chert. Some karst features were observed in the area and in the subsurface near this site.

Depth to groundwater is 10 to 15 feet. Shallow groundwater flow is likely to the west, following surface topography. Surface water discharges to a drainage ditch along 12th Avenue, and overland to an unnamed tributary to Prairie Creek. Municipal drinking water for the city of Ava is obtained from public water

supply wells open to the Ozark Aquifer, of which the Jefferson City Dolomite is a part.

Public Drinking Water Advisory:

The city of Ava uses several deep wells that draw from the unconfined Ozark aquifer. One city well is located within 100 meters of this site. This well is cased 390 feet deep and monitored quarterly until 2010, at which time monitoring returned to annual testing. No contamination related to this site or the Sentinel Wood Treating site (also located about 100 meters from this well) is recognized. Since the Ozark aquifer is not confined in this region, the possibility of downward, vertical movement of contaminants does exist, and monitoring data should continue to be assessed with diligence to ensure this well, and Ava's other wells, continue to produce safe water.

Health Assessment:

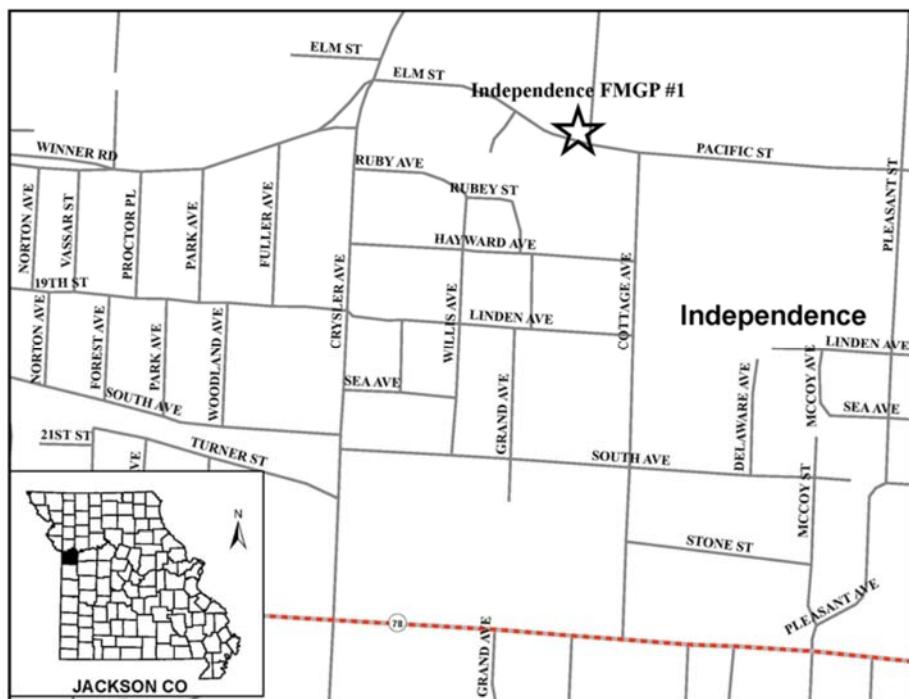
The primary contaminants of concern associated with the site include PCE and its natural degradation products, TCE, vinyl chloride, and cis-1,2-DCE. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Inhalation, direct contact, and ingestion of contaminated surface water are potential routes of exposure at this site. Two springs that feed into the Prairie Creek tributary are used occasionally by children and adults for recreational purposes. These springs have had PCE detections. A water treatment system adjacent to the stream tributary reduces the risk of exposure to PCE-contaminated stream water.

Based on available information, a health threat exists. On-site soil, groundwater, and surface water showed detections of PCE above levels of health concern in 2016. This site is unrestricted and thus poses a threat to individuals using this area. Should further removal actions take place, workers could become exposed to contaminated media.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Independence FMGP #1



Site Name: Independence FMGP #1

Classification: Class 3

Date of Registry Placement: November 28, 2000

Site Address: Northwest of the intersection of West Pacific Avenue and S. River Boulevard., Independence, Jackson County, Mo.

Present Property Owner: Reorganized Church of Jesus Christ of Latter Day Saints (RLDS)

Lead Agency: Missouri Department of Natural Resources

Waste Type: Coal tar, which contains volatile organic compounds (VOCs) and semi-volatile organic compounds, including polycyclic aromatic hydrocarbons (PAHs)

Quantity: Not determined

Site Description: The site is located in an area with a combination of residential, commercial, and light industrial land uses. Department staff conducted a comparison of historic Sanborn Fire Insurance maps to present day conditions on site and found that

gas plant operations have occurred on property currently owned by Reorganized Church of Jesus Christ Latter Day Saints (RLDS). In addition to the RLDS property, several of the plant operations buildings were located on land that lies beneath what is now West Pacific Avenue. The site is located within the drainage basin along the southeast edge of the RLDS Auditorium parking area and extends beneath West Pacific Avenue. Currently, the entire basin area is covered by healthy vegetation, and access is not restricted. There are no visual remains of the former gas plant structures on site.

Former Manufactured Gas Plant structures associated with the Coal Gas Works (later called the Jackson County Light, Heat, and Power Co. Gas Works) appear on historic Sanborn maps as early as 1885 and as late as 1898. The structures depicted included three gas holders, retort houses, and purifiers. No information is available regarding operations after the closing of the manufactured gas plant circa 1926 and prior to the construction of the drainage basin in the early 1990s by RLDS.

Environmental Problems and Areas of Concern:

Department staff collected subsurface soil

samples from the approximate location of the former manufactured gas plant that contained VOCs and carcinogenic PAHs at concentrations greater than health-based screening levels. One sample contained leachable benzene concentrations that exceeded the Toxicity Characteristic Leaching Procedure regulatory limit of 0.5 parts per million making this sample characteristic hazardous waste based on toxicity. The coal tar remaining in the subsurface may pose human health risks should any excavation or accidental uncovering occur in the future.

Remedial Action:

The Department's Hazardous Waste Program completed a pre-Comprehensive Environmental Response, Compensation and Liability Information System Site Screening report in May 2000. Coal tar, a byproduct of the gas manufacturing process, is the primary waste of concern on site.

The Department's Site Screening report concluded that the majority of contamination is located six to seven feet below ground surface and is not expected to pose a significant air or soil exposure risk. No residents or workers are on site. While access is not restricted, visitation to the site is unlikely because of a large drainage basin and paved street that now occupy the former gas plant operations properties. Although hazardous substances are present, the potential for exposure and migration off site is minimal. The Department did not recommend taking further Comprehensive Environmental Response Compensation and Liability Act action at the time of the Site Screening, provided that institutional controls are in place and state oversight of future activities at the site is ensured.

Department staff completed the Fiscal Year 2018 Registry annual inspection on April 25, 2018. Nothing of significance was noted.

General Geologic and Hydrologic Setting:

The site is located on the rolling, loess-covered hills immediately south of the Missouri River in the Kansas City region. It lies outside of a 50-year flood plain. Loess-derived surface soils at the site are composed of silt loam to silty-clay with a moderate permeability. Roughly five to 24 feet of loess and glacial till overlie the local bedrock.

Kansas City Group Pennsylvanian-age bedrock at the site consists of 450 feet of one to 20-foot-thick beds of alternating limestone and shale with infrequent thin coal beds. Surface water infiltrates the shallow limestone layers which, in turn, form small intermittent springs on the hills.

Deep groundwater in the Kansas City region rarely is used for drinking purposes due to high mineral content. Groundwater in formations near the site is encountered at depths of 24 to 55 feet below the surface.

Public Drinking Water Advisory:

The city of Independence obtains groundwater from Missouri River alluvial deposits located approximately 5 miles north-northeast of the site. No impacts are expected to the city of Independence's well field, and no other public water sources are located near the site.

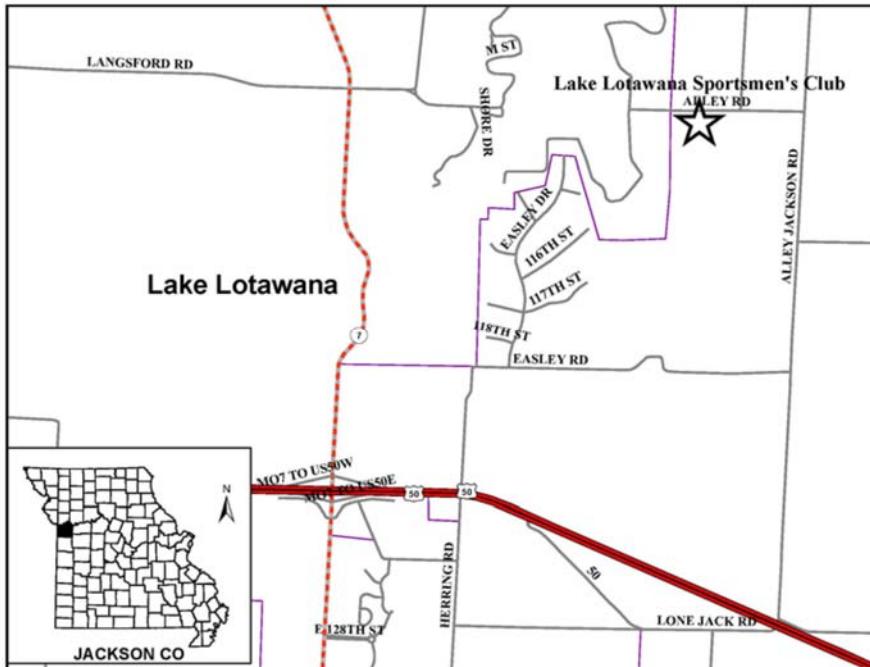
Health Assessment:

The contaminant of concern at this site is coal tar, which contains VOCs and semi-volatile organic compounds, including PAHs. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Most site contamination is located in subsurface soils and is not expected to pose an exposure risk. Furthermore, no residents or workers are located on the site, and the potential for exposure and migration off site is minimal. Disturbance of the subsurface soil would increase the chance for public exposure to the buried hazardous wastes. No significant health risk exists on site unless the subsurface soils are disturbed.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Lake Lotawana Sportsmen's Club



Site Name: Lake Lotawana Sportsmen's Club

Classification: Class 3

Date of Registry Placement: July 31, 2001

Site Address: 29709 Alley Road, Lake Lotawana, Jackson County, Mo.

Present Property Owner: Lake Lotawana Sportsmen's Club, Inc.

Lead Agency: Missouri Department of Natural Resources

Waste Type: Lead

Quantity: Not determined

Site Description: The Lake Lotawana Sportsmen's Club Site is an active, private sport club that has operated as a recreational small arms firing range since 1977 under a special-use permit from Jackson County. The site, approximately 60 acres in size, has unrestricted access and is surrounded by nearby residences.

A formal complaint registered with the Department regarding possible lead contamination prompted an investigation in September 2000. Lead, associated with the

operation of the firing range, is the primary waste of concern.

Environmental Problems and Areas of Concern:

A 2001 Pre-Comprehensive Environmental Response, Compensation, and Liability Information System Site Screening investigation determined surface soils contained elevated concentrations of lead as high as 4,700 parts per million. One sample contained leachable lead at a concentration of 181 parts per million, exceeding the Toxicity Characteristic Leaching Procedure regulatory limit of 5.0 parts per million, making this sample characteristic hazardous waste based on toxicity. Low concentrations of lead were detected in downgradient sediment samples collected from an intermittent stream indicating that some lead may be migrating off site. However, no significant accumulation of lead is expected in the stream.

Remedial Action:

The 2001 Site Screening investigation concluded that under current site conditions, no significant exposure risk is present through the soil pathway or surface water pathway. Access to the contaminated soil is limited as long as the site remains a firing range. Further action under Comprehensive Environmental

Response, Compensation, and Liability Act authority was not recommended provided that institutional controls were put in place and state oversight of future activities was ensured. The site may be eligible for further Comprehensive Environmental Response, Compensation, and Liability Act investigation if the firing range is closed and the property is used for other purposes, such as residential development, thereby increasing the risk of exposure to lead-contaminated soil.

In June 2013, investigation of this site was reopened due to a citizen's concerns that lead could have migrated off of the firing ranges into nearby Lake Lotawana via two intermittent streams that converged on the site during the flooding event. Multiple plastic shotgun waddings had washed downstream and into Lake Lotawana. Past Registry annual site inspections noted that the flooding has caused erosion in the form of a big gully in the trap shooting range area where the debris lands.

In July 2013, the Department conducted surface water and sediment sampling of the intermittent creeks that receive drainage from the shooting range as part of a Site Inspection investigation. A release of hazardous substances, specifically lead and polycyclic aromatic hydrocarbons (PAHs), was documented in the sediment of the creek on club property and downstream, off club property, at the creek outflow to Lake Lotawana. The levels of lead in the creek sediment exceed environmental sediment quality standards but not residential health-based benchmarks. The levels of PAHs exceed both environmental sediment quality standards and EPA's residential and industrial health-based benchmarks. The PAH contamination is associated with the clay targets used at shooting ranges. Surface water samples from the creek do not show any PAH contamination, and the relatively low levels of dissolved lead in the water are below Missouri Water Quality Standards. Further, fish tissue samples collected from Lake Lotawana in August 2013 did not show any lead contamination at levels of health concern. Only two of nine samples contained any detectable levels of lead – both more than 10 times below the Missouri Fish Fillet Advisory Concentration.

The Gun Club requested a special use permit from Jackson County to conduct a lead

reclamation project. The project involves the scraping and grubbing of the topsoil, which contains lead pellets distributed from the target practicing activities. The estimated total area to be disturbed is approximately five acres. Once the topsoil is collected, it will be sifted on site by mechanical means in order to separate the shot pellets from the soil. Soil will be replaced in the areas where it was removed. On November 17, 2017, Jackson County granted this permit. The reclamation activities commenced November 2017, but the work was stopped December 2017 due to weather. Work started again April 2018. The estimated completion date is summer or fall 2018.

After the lead reclamation project is completed, the Department will conduct further sampling of sediment from the intermittent creek on the neighboring property and in Lake Lotawana to define the extent of site contamination migration. Further, a Health Consultation from Missouri Department of Health and Senior Services to evaluate the risk of exposure to residents who may come into contact with creek sediment will be requested to aid in determining whether cleanup of contaminated sediments in the creek is warranted.

The Fiscal Year 2018 Registry annual inspection was completed by the Department on April 19, 2018. Two covered stockpiles of soil from the reclamation work were observed on the west side of the property, and blue sediment fencing was erected in the southeast area of the property areas where soil is being excavated.

General Geologic and Hydrologic Setting:

The site is located in the Osage Plains subdivision of the Central Lowlands physiographic province, just south of the inferred southern limit of glaciation. This area has narrow, thin loess-covered ridges composed of moderately permeable silt and silty clay, with low permeable clay increasing with depth, and a thickness of 10 to 20 feet. Drainage ways dissect these ridges. Below the loess-covered ridge, the slope is steeper, and the loess has been eroded, exposing residual soil five feet thick or less, composed of more permeable stoney, silty clay.

Pennsylvanian-age bedrock of lower Kansas City Group consists of cyclic deposits of shale

and limestone with low overall permeability. Groundwater, which accumulates on Pennsylvanian-age shales, is pumped from shallow wells. The depth to groundwater is about 30 to 40 feet below ground surface. A perched seasonal water table of two to three feet has been reported for soils on the steeper side slopes. Local shallow groundwater flow is expected to mimic topography and flow to the southwest toward Lake Lotawana. Regional groundwater flow is expected to be to the north toward the Missouri River. The recharge to the aquifer in this area is very limited, only from direct precipitation infiltration. The Kansas City Group is underlain by thick shale of the Pleasanton Group, which is considered to be non-water-bearing and a barrier to deeper, highly mineralized water-bearing units.

Surface water flows south to an intermittent stream that enters Lake Lotawana. Lake Lotawana discharges to the West Fork of Sni-A-Bar Creek. Sni-A-Bar Creek enters the Missouri River in western Lafayette County.

The potential for groundwater contamination is low to moderate in this area due to low permeabilities of the underlying bedrock. Surface water is much more susceptible to contamination than the groundwater system.

Public Drinking Water Advisory:

The nearest public water source to this site is over 8 miles away. No site-related impacts are expected.

Health Assessment:

The chemical of concern at this site is lead. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

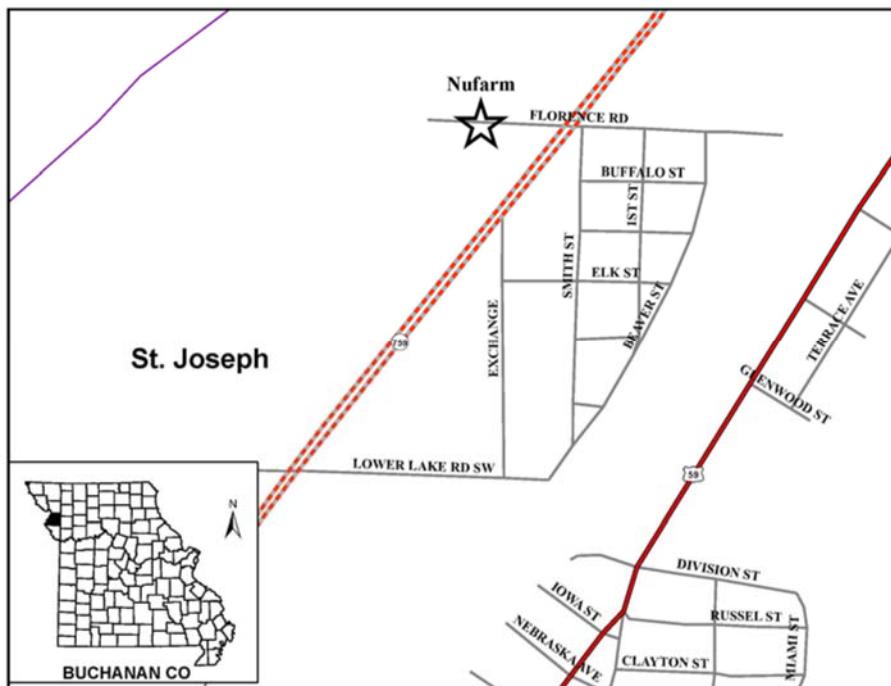
The primary health concern is human exposure from ingestion and inhalation of lead by Sportsman's Club users. Club members may incidentally ingest and inhale lead-contaminated dust by way of shooting activities at the site. As with any hobby or recreational activity involving lead, Missouri Department of Health and Senior Services recommends hand washing before eating or drinking as well as removing and cleaning clothes and shoes to prevent tracking lead

inside the home.

Based on the possibility of ingestion or inhalation of fugitive dust, this site poses a low potential health risk for Sportsman's Club users.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Nufarm



Site Name: Nufarm

Classification: Class 3

Date of Registry Placement: August 3, 1998

Site Address: 317 Florence Road, St. Joseph, Buchanan County, Mo.

Present Property Owners: HPI Products Inc.

Lead Agency: Missouri Department of Natural Resources

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and 2,4,5-TP (Silvex)

Quantity: Not determined

Site Description: In 1956, Amchem Products began operations at an herbicide formulation and metalwork production facility in St. Joseph on a 7.84-acre parcel near the Missouri River. Amchem formulated herbicides containing the active ingredients 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4-trichlorophenoxyacetic acid (2,4,5-T). These formulations sometimes produced the unwanted byproduct TCDD. In 1975, the facility ceased formulating these herbicides.

Soon thereafter Union Carbide purchased the

property and began formulating other herbicides. In 1986, Rhone-Poulenc bought the herbicide formulation facility. The company acquired only the property (2.5 acres) containing the facility. Union Carbide retained the remaining 5.34 vacant acres. In December 1997, Rhone-Poulenc sold the 2.5 acre property and facility to Nufarm, Inc. On October 15, 2001, HPI Products Inc. purchased the plant from Nufarm.

Contamination at the two properties dates from the period between 1956 and 1975, when herbicides containing TCDD were formulated by Amchem on site. The separate property retained by Union Carbide is the former location of a lagoon used for waste disposal. The 2.5-acre Nufarm site contains the storage tank and rail area, where railcars transporting chemicals and herbicides were loaded and unloaded by Amchem personnel. The probable source of soil contamination originates from spillage that occurred during loading and unloading. In 1985, samples taken by EPA show TCDD levels at 7.1 parts per billion in the rail area and at 4.5 and 3.4 parts per billion at the surface in the storage tanks area. The common cleanup standard for TCDD was 1 part per billion at less than one foot in depth or 10 parts per billion at greater than one foot. The Nufarm site is south of the Union Carbide site. Both properties are listed on the *Registry*. The site is fenced with a

locked gate.

Environmental Problems and Areas of Concern:

The Missouri River is about 50 yards away. Groundwater has not been thoroughly evaluated at the site.

Remedial Actions:

In 1988, Pacific Environmental Services collected samples for Union Carbide. TCDD was not detected in the railcar area although 2,4-D was found at low levels. The tank storage area had been capped due to heavy traffic and therefore was not accessible for sampling.

In July 1995, Nufarm initiated a soil characterization study as part of planned repairs to the deteriorated rail siding. One sample revealed TCDD at 1.1 parts per billion. The value was later revised following retesting; the retested value was 0.41 parts per billion. In this area, about one foot of gravel had to be excavated before soil was encountered. However, a composite of all soil samples collected by the Nufarm contractors failed the Toxicity Characteristic Leaching Procedure with 4.6 parts per million of 2,4,5-TP (Silvex).

No further actions have occurred at the site. The Fiscal Year 2018 Registry annual inspection was completed by the Department on May 16, 2018. Nothing of significance was noted.

General Geologic and Hydrologic Setting:

The Nufarm site is located on the alluvium of the Missouri River flood plain. The 60- to 100-foot thick alluvium consists of low permeability, fine-grained clay and silt at the surface, grading with depth to coarser sand and gravel units with high permeability. Sand units typically are encountered within 20 feet below grade, and the gravel seams are present nearer the alluvium/bedrock contact. Depth to the water table is 10 to 20 feet. The alluvial aquifer, which is an important source of water for local industry, is in direct hydraulic communication with the Missouri River.

Under normal flow conditions, groundwater beneath the site flows west toward the Missouri River. The river occasionally floods

the site. High river stages could reverse the groundwater flow direction. High-yield wells in the vicinity of the site may also affect the direction of groundwater flow. Release of contaminants at the site would readily affect the alluvial aquifer through direct infiltration and dissolution.

The bedrock beneath the site is composed of Pennsylvanian-age limestones and shales. Since this type of bedrock exhibits low permeability, release of contaminants would have minimal effect on the bedrock aquifer. Due to the heavy mineralization of water within the bedrock, this aquifer is not used as a water source.

Public Drinking Water Advisory:

Missouri American Water – St. Joseph draws water from the Missouri River alluvium, but their well field is upstream of this site, and no site-related impacts are expected. No other public water sources are located near the site.

Health Assessment:

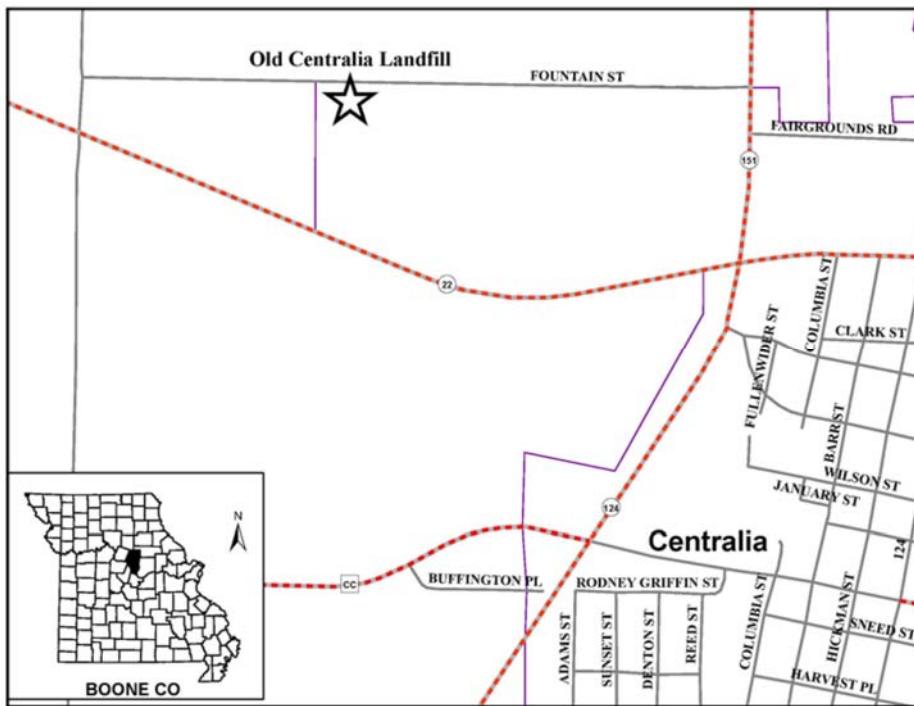
TCDD is the chemical of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

The site is located in an industrial area, but residential neighborhoods are less than one mile north and less than one-half mile southeast. The site is fenced and much of the TCDD contamination on the Union Carbide site is subsurface, covered by clean soil and gravel.

Based on the available information, the Missouri Department of Health and Senior Services have determined that this site does not appear to present a significant health risk to the public at this time. The site has been capped. If the use of this site were to change, or excavation or surface grading exposed contaminated soil, exposure to TCDD-contaminated soil could occur.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Old Centralia Landfill



Site Name: Old Centralia Landfill

Classification: Class 3

Date of Registry Placement: August 20, 1990

Site Address: 0.6 miles west of Centralia, along north side of Highway 22, Boone County, Mo.

SE 1/4, NW 1/4, Sec. 9, T. 51N, R. 11W, Centralia Quadrangle

Present Property Owner: City of Centralia

Lead Agency: Missouri Department of Natural Resources

Waste Type: Metals (primarily lead)

Quantity: Not determined

Site Description: The city of Centralia operated the Old Centralia Landfill for the disposal of municipal and industrial solid waste from 1950 to 1961. The landfill was operated as an open dump that was occasionally "open burned" and covered with soil. The Department's reports indicate unknown quantities of potentially hazardous materials, generated by the A. B. Chance Company, were also disposed periodically at the landfill and burned in the open. Analytical

results substantiate that hazardous materials were disposed at the site. Soil samples contain metals at elevated levels. Lead has been identified as the primary contaminant of concern in the soil at the northeast corner of the landfill. Lead levels detected in this area are significantly above background and health-based screening levels, thereby characterizing this material as hazardous. The site has been inactive since 1961.

Land in the immediate vicinity is used primarily for agricultural row crops. Houses are scattered in all directions except to the east where Centralia lies. The nearest residence is about 0.5 mile. Goodwater Creek flows on the east side of the site.

Environmental Problems and Areas of Concern:

Vegetation has been damaged, with possible residual effects on growth. Vegetation is very sparse in the lime dump area. In 2002, soil on the north end of the site was re-worked to control erosion. Elevated metals detected in sediment samples from nearby Goodwater Creek indicate metals have migrated. Past leachate seeps have been documented.

Remedial Actions:

In 1990, the Department completed a Site

Inspection, and forwarded the results to EPA. The Department requested that EPA assess this site for a potential removal cleanup under Superfund, but it was not completed.

During 1992, the city of Centralia fenced the site, posted "No Trespassing" signs, and installed a locked gate to eliminate access. However, since 1992, annual Registry inspections by the Department repeatedly have found the signs and gate damaged or inoperable. Debris found also indicates trespassing. No further remedial actions have occurred. In 2002, soil on the north end of the site was re-worked to control erosion. Elevated metals detected in sediment samples from nearby Goodwater Creek indicate metals have migrated. The elevated metals detected in the sediment samples in Goodwater Creek in 2002 are most likely attributable to the past disposal activities at the site. The Fiscal Year 2018 Registry annual inspection conducted on May 16, 2018, by the Department noted that the cap of the landfill is well vegetated and no erosion or ponding was present on site.

General Geologic and Hydrologic Setting:

The site is located in an upland setting on a nearly flat, glaciated plain and is characterized by 50 to 60 feet of glacial till, overlain by three to five feet of loess topped with two to three feet of silty clay. Sand and gravel lenses may be present in the glacial till, but coarse-grained deposits are not continuous over a wide area. This profile represents undisturbed conditions; the depth of the landfill cut and the origin of the cover is unknown.

Geologic mapping indicates that underlying bedrock is composed of Pennsylvanian-age shales, limestones, clay, and coal beds. The glacial till and shaly bedrock have low permeability and thus form a confining layer that minimizes leachate migration into deeper groundwater supplies. Only shallow or poorly-constructed wells would be affected.

Public Drinking Water Advisory:

The city of Centralia operates two active public water wells located approximately 0.7 and 0.9 miles southwest of the site. Both wells are cased over 400 feet deep, and site-related impacts are not expected.

Health Assessment:

The following are the major contaminants of concern found in soil, surface water, and sediment: copper, lead, nickel, and phenanthrene, a polycyclic aromatic hydrocarbon (PAH). Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

The most likely routes of exposure are through direct contact with contaminated soil, sediment, and surface water. Elevated levels of copper, lead, and nickel were found in the soil of the northeast corner of the site. Analysis of downgradient sediment and water samples indicated that contaminants have moved off site. Even though phenanthrene was found in only one sample, the presence of phenanthrene and other PAHs is expected because of past burning practices.

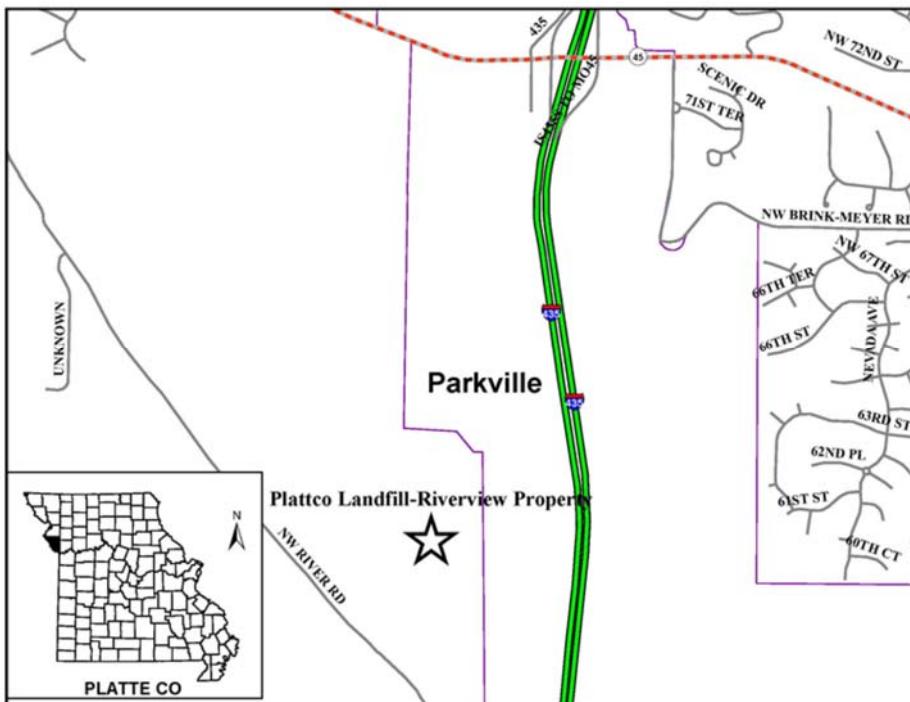
The potential for groundwater contamination may exist. Seepage from the buried wastes is occurring, and in time, contaminants could reach the groundwater. Centralia is served by two deep wells, but there are limited reports of other groundwater use in the immediate vicinity. Centralia and most rural homes in the Old Centralia Landfill vicinity utilize public water. Missouri Department of Health and Senior Services have sampled private wells near the site annually and have never detected any contaminants in the water.

Based on available information, the contaminants in the Old Centralia Landfill Site may present a health threat to the general public. The fact that contaminants have moved off site presents a potential risk because they are persistent in the environment and could eventually flow into Mark Twain Lake. Other considerations are that (1) the contaminants could migrate into the groundwater, (2) the public may disregard the access restrictions and become exposed when trespassing, and (3) the maintenance of a utility transecting the site may expose workers to surface and subsurface soil contamination and to landfill material. A Site Reassessment may better delineate concerns of off-site migration of remaining contamination.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services,

P. O. Box 570, Jefferson City, MO 65102,
573-751-6102.

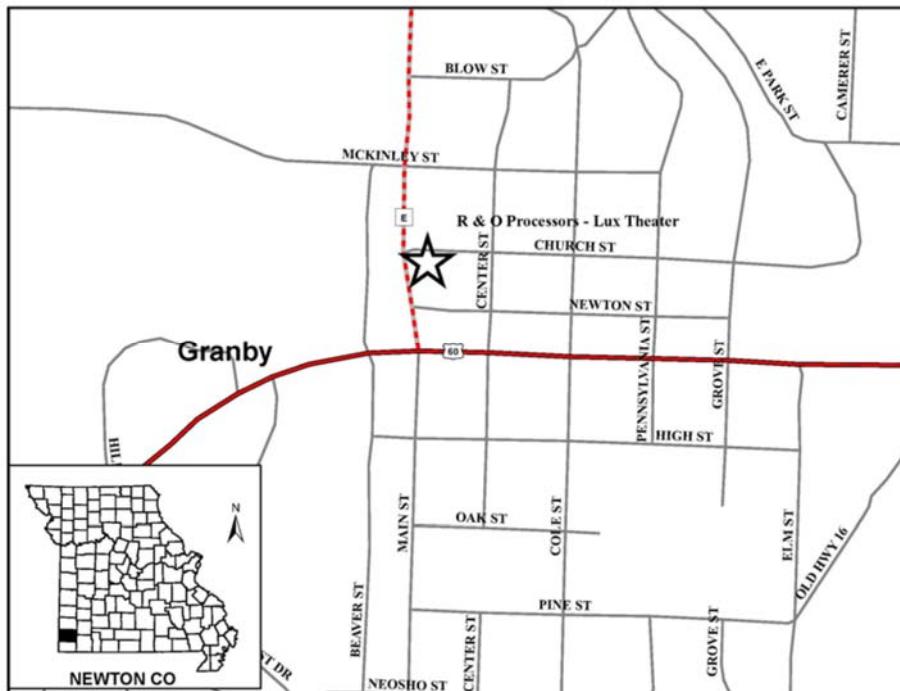
Plattco Landfill-Riverview Property



Site Name: Plattco Landfill-Riverview Property

Status: On May 21, 2018, BFINA petitioned the Missouri Department of Natural Resources to delete the site from the Registry. This pending petition is under review by the Department and a final determination has not been made at the time of this year's publication.

R&O Processors/Lux Theater



Site Name: R&O Processors/Lux Theater

Classification: Class 3

Date of Registry Placement: October 9, 1996

Site Address: Church and Main, Granby, Newton County, Mo.
SE 1/4, NE 1/4, NW 1/4, Sec. 6, T.25N, R. 30W, Granby Quadrangle

Present Property Owner: Ira and Betty Hawkins

Lead Agency: Missouri Department of Natural Resources

Waste Type: Metal plating wastes (lead, cadmium, zinc, chromium, cyanide, nickel and copper)

Quantity: Not determined

Site Description: The R&O Processors/Lux Theater site is an abandoned electroplating facility located in downtown Granby. From 1973 to 1981, R&O Processors operated a metal-finishing plant at the site of the former Lux Theatre. Plating operations included zinc, chromium, nickel, black oxide, cadmium, and anodizing aluminum plating. In 1985, part of the building collapsed, which necessitated

demolition of the entire building. Subsequently, several drums containing hazardous waste were found in the building rubble.

The foundation of the former building that housed R&O Processors was encased in clean concrete. An alleyway separates the foundation from a property to the east. Main Street is the western border and Church Street is the northern border of the site.

Environmental Problems and Areas of Concern:

While R&O Processors operated the site, an estimated six million gallons of metal-plating rinse water were dumped down a 40-foot-deep mining shaft on site. This number was obtained by calculating that 15,000 gallons of rinse water per week were disposed on site over an eight-year period. Robert Moffet, former operator of the site, acknowledged that rinse waters contained cyanide and metals. This is documented by EPA in a suit filed against Moffet in 1983. The site is unsecured and readily accessible to the public.

Remedial Actions:

In 1985, twelve drums containing hazardous waste were found inside the collapsed

building. Chemical Waste Management removed and moved them to the R&O Processor location on Highway 60 in Granby.

Site investigations identified cadmium, chromium, copper, cyanide, lead, nickel, and zinc in soil and cadmium in groundwater. In 1998, the Missouri Department of Health and Senior Services completed a Streamlined Risk Assessment, which concluded that although cadmium and copper were present in the soil above background levels, the metals were not detected at levels that would cause health-related problems from worker exposure to the soil.

EPA's 1995 Expanded Site Inspection could not state definitively that the elevated metals in soil were attributable to the R&O site as compared to the background metal levels, which are high in Granby due to the mining history. The public wells were sampled as part of the Expanded Site Inspection and no metals were detected. EPA determined that no further federal action would be taken at this site.

In 2001, the property was donated to the Granby Economic Property Development Corporation, and the Department approved the redevelopment plan to encapsulate contaminated concrete and soil with a concrete foundation. The Granby Economic Property Development Corporation removed the former buildings and new foundations and concrete walls were poured. The site was backfilled with gravel and was used as a parking lot for the city.

On September 19, 2017, Ira and Betty Hawkins bought the property from the Granby Economic Property Development Corporation. The Fiscal Year 2018 Registry annual inspection, completed by the Department on May 10, 2018, noted that the foundation is intact. The new owners planned to concrete over the entire property, but due to cost, they were unable to follow through with that plan.

General Geologic and Hydrologic Setting:

In general, the topography is characterized by uplands gently sloping to stream valleys. The site is located in an urbanized area where the topography has been altered by cut and fill excavation to provide a level surface for building construction. Natural surface soil is composed of cherty, red clay residuum that

ranges from 10 to 40 feet in thickness. The soil is derived from weathering of the underlying bedrock. Generally, the fill is similar to natural soil, and both exhibit moderate to high permeability.

The upper aquifer is composed of Mississippian-age strata, which are primarily limestone units with a total thickness of 250 to 300 feet. The lower aquifer, encountered about 800 feet below grade, is composed of sandstone and dolomite units of Ordovician age. The upper and lower aquifers are separated by confining beds composed of shale. The limestone and dolomite units are highly permeable due to solution enlargement of bedding planes and joints. The local area is karst, characterized by sinkholes, losing streams, springs, and caves.

Most private residences obtain water from low -yield wells that penetrate the upper bedrock aquifer and, in some cases, the overlying residuum. Water supply wells that require high yields, such as municipal wells, penetrate the lower aquifer. Poorly-constructed wells may facilitate migration of contaminants from the ground surface to the deeper, potable aquifers.

Public Drinking Water Advisory:

The city of Granby uses two public water wells that are located approximately 0.5 miles to the west and 0.8 miles southwest of the site. Both wells draw from the Ozark aquifer and are cased at least 450 feet deep. Contamination from the site is not likely to impact these wells, but questions regarding the extent of groundwater contamination in the upper Springfield Plateau aquifer (characterized by karst features, rapid groundwater movement, and surface water infiltration) are still a concern. Existing wells that are poorly constructed or abandoned, or fractures in bedrock, may allow localized mixing between the upper and lower aquifers.

Health Assessment:

Cadmium, chromium, copper, cyanide, lead, nickel, and zinc were some of the inorganic metals found on this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

The addition of gravel and concrete in 2001 to the site reduced the potential for exposure through contaminated soil. The primary health concerns are potentially contaminated groundwater. A subdivision well located east of the site was sampled in 2002 by the Missouri Department of Health and Senior Services and lead was detected but below the action limit of 15 parts per billion. A private well near the site was also sampled by the Missouri Department of Health and Senior Services in 2002 and contained lead above 15 parts per billion and cadmium above the Maximum Contaminant Level of 5 parts per billion.

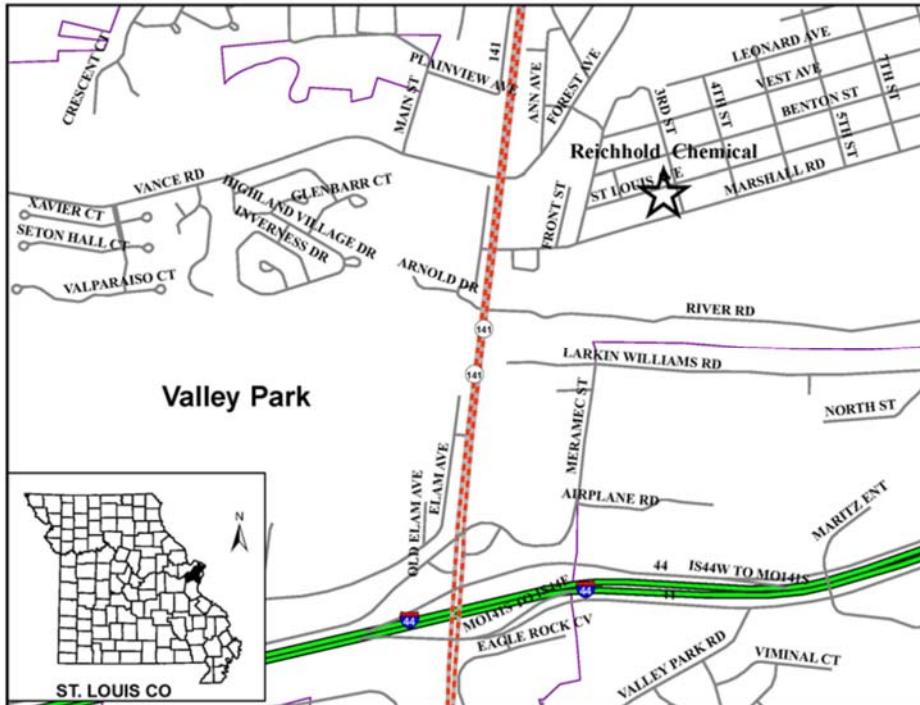
In 2003, and again in 2005, this private well contained a cadmium concentration at 6 parts per billion, which is slightly higher than the Maximum Contaminant Level of 5 parts per billion. In 2007, a new well was drilled at this residence. Later that same year a water sample was collected from this new well and tested for metals. No metals were detected in this sample above the EPA's Maximum Contaminant Level. Groundwater apparently flows northward toward a losing stream. The proximity of the site to the municipal well and the karst geology of the area contribute to health concerns.

In 2009, a tornado struck the area and power was lost for weeks. None of the private well owners wanted their well tested even after power was restored. No wells have been sampled around the site since 2007 because many of the homes have been torn down after the tornado. The nearest remaining home appears to be abandoned. Any remaining clients on the original sampling plan denied access for well sampling. The status of any nearby wells remains unknown.

Based on available information, wells near the site may be at risk due to unknown contaminant levels in nearby wells.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, (573) 751-6102.

Reichhold Chemical



Site Name: Reichhold Chemical

Classification: Class 3

Date of Registry Placement: March 15, 2001

Site Address: 249 St. Louis Ave., Valley Park, St. Louis County, Mo.

Present Property Owner: Reichhold LLC 2
Reichhold, LLC filed for bankruptcy in September 2014 and later transferred their assets to Reichhold LLC 2.

Lead Agency: Missouri Department of Natural Resources

Waste Type: Volatile organic compounds (VOCs), primarily xylene

Quantity: Not determined; an unknown volume of solvent was released, contaminating about 48,000 cubic feet of soil, which remains on site.

Site Description: The Reichhold Chemical (Reichhold) site covers 2.5 acres surrounded by industrial, commercial, and residential property. Reichhold manufactures oil- and solvent-based resins. As part of the production process, industrial grade xylene is used to remove wastewater from the resin

materials. The resulting xylene-wastewater mixture is collected in an above-ground 15,000-gallon decanter recovery tank in which the solvent is separated and retrieved for later reuse. In 1997, a release of an unknown volume of solvent occurred from the decanter tank containment drain. The solvents migrated along the conduit of a buried wastewater line and contaminated soils.

The site, which is fenced securely, is covered with structures and a cement parking lot. The cement parking lot acts as a cap protecting workers and other individuals from potential exposure to subsurface contamination.

Environmental Problems and Areas of Concern:

Xylene and ethylbenzene are present at concentrations above health-based screening levels in the subsurface soil. The industrial grade xylene, a recovered chemical product, is listed as an EPA hazardous waste U239. Subsurface contaminants may pose human health risks if accidental uncovering, removal of the cement cap, or excavation would occur.

The site lies above a trichloroethene (TCE) groundwater plume about 70 acres in size and attributed to the Valley Park TCE Superfund site. A Remedial Design/Remedial Action for groundwater and subsurface contamination is

in progress at the Valley Park TCE site.

Remedial Action:

After a 1997 release of an unknown volume of solvent from the decanter tank containment drain, the faulty drain was repaired, the decanter tank containment was sealed, and the sewer lateral was plugged with cement to prevent further contamination of the sewer system. A recovery sump was installed in the sewer lateral to retrieve any free solvents that continued to infiltrate, but very little solvent was recovered.

In September 2000, the Department completed an Integrated Preliminary Assessment/Site Inspection/Removal Site Evaluation. The evaluation concluded that the soil contamination is effectively capped by the parking lot. Therefore, further action under Comprehensive Environmental Response, Compensation, and Liability Act was not recommended provided that institutional controls are in place and state oversight of future activities is ensured.

In May 2003, the Department approved a change of use request for excavation and test borings for installation of a new product line. In December 2003, the Department approved a change of use request to replace a leaky underground drain line in building 13. In 2015, the Department approved a change use request to excavate (disturb) a small portion of the paved cap (asphalt cover) to relocate a portion of the wastewater subsurface drain pipe that is connected to an above-ground storage tank located inside a secondary concrete containment structure.

In March 2011, the Department and EPA conducted city-wide groundwater sampling of the known monitoring well locations in Valley Park. The purpose of the groundwater sampling was to define the monitoring well locations and plume boundaries of VOCs in the off-site groundwater. During this monitoring event, groundwater samples were collected near the Reichhold facility for analysis from one intermediate well (MW-6B) screened at 45 feet depth; two monitoring wells (MW-6C and MW-10C) screened along the bedrock at a depth of approximately 60 feet; and the industrial production well located on the Reichhold site, which is screened at a depth of approximately 60 feet. All four of these wells had low level concentrations of

tetrachloroethene, TCE, and cis-1,2-dichloroethylene. No BTEX (benzene, toluene, ethyl benzene and xylene) compounds or other identified compounds associated with the release from the Reichhold above-ground decanter tank were detected in the four wells.

Based on these results, the contaminants associated with the release do not appear to be impacting the local aquifer at the intermediate and deep depths in these wells. Since the time of the release, any potential volatile VOCs would have been intercepted by the Reichhold production well and/or degraded by natural processes. Although the 2011 well data did not show VOCs associated with the release at the Reichhold facility within the local aquifer at the depths indicated, a potential threat will exist as long as VOC contamination remains in the subsurface. The Department recommended follow-up groundwater sampling in the release area to determine if a human health impact is present. In January 2015, EPA sampled two wells on the Reichhold property and detected concentrations of 57 parts per billion acetone in both wells, 2.3 parts per billion cyclohexane in the intermediate well, and 1.3 parts per billion cyclohexane in the deeper well.

The Valley Park TCE site was investigated by EPA in 2014 and 2015 to determine if a vapor intrusion is occurring in residences and business adjacent to the two Superfund source properties, which was to include the Reichhold Chemical buildings. Twenty-three properties were sampled. Samples from twenty-one properties did not detect site contaminants above levels of concern, and no further actions were warranted. Samples at the other two properties detected site contaminants above levels of concern. The agency installed mitigation systems at the two properties, and no further actions are required at either, besides Operation and Management of the systems. Reichhold refused access, although this was a recommendation of the Valley Park TCE site third Five-Year Review issued September 2013.

The annual Registry inspection was conducted April 20, 2018, by the Department and noted nothing of significance. No other activities were reported through June 2018.

General Geologic and Hydrologic Setting:

The site is located nearly 0.3 mile north of the

Meramec River on the 10-year flood plain. The surrounding terrain is flat with no levee between the property and the river. About 65 feet of moderately to highly permeable alluvium underlies the site. According to nearby monitoring wells, the alluvial sediments predominantly comprise silty sand with some clay and gravel in the upper 35 feet, overlying 30 feet of sand and gravel.

Depth to groundwater averages 30 feet and fluctuates with the river level and pumping rates of the Reichhold production well. Alluvial groundwater is recharged by surface infiltration and discharge from the bedrock hills located north and west of the site. Groundwater flows within the alluvium toward the Meramec River to the south-southeast. Locally, the alluvial aquifer is used for industrial wells and Kirkwood municipal wells. Bedrock consists of cherty, medium- to coarsely-crystalline 200-foot-thick Burlington-Keokuk Limestone. Voids have been found in the limestone bedrock; therefore, it is probably karstic. The bedrock aquifer is used as a drinking water source in the nearby upland areas, but not in the river valley.

Public Drinking Water Advisory:

No public water sources in the immediate vicinity of this site. Missouri American Water – St. Louis Co./St. Charles Co. draws water from the Meramec River over 10 miles downstream of this site. No site-related impacts are expected.

Health Assessment:

The contaminants of concern at this site are VOCs, primarily xylene. Industrial grade xylene typically contains other solvents and may be as much as 30 percent ethylbenzene. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

The primary exposure route of concern is through groundwater. Although not currently active, Valley Park's public well field is down gradient and very near the site.

Although the 2011 well sample results at the Reichhold property did not show VOCs associated with the release, the 2015 sample results did show detections of VOC compounds. As long as VOC contamination

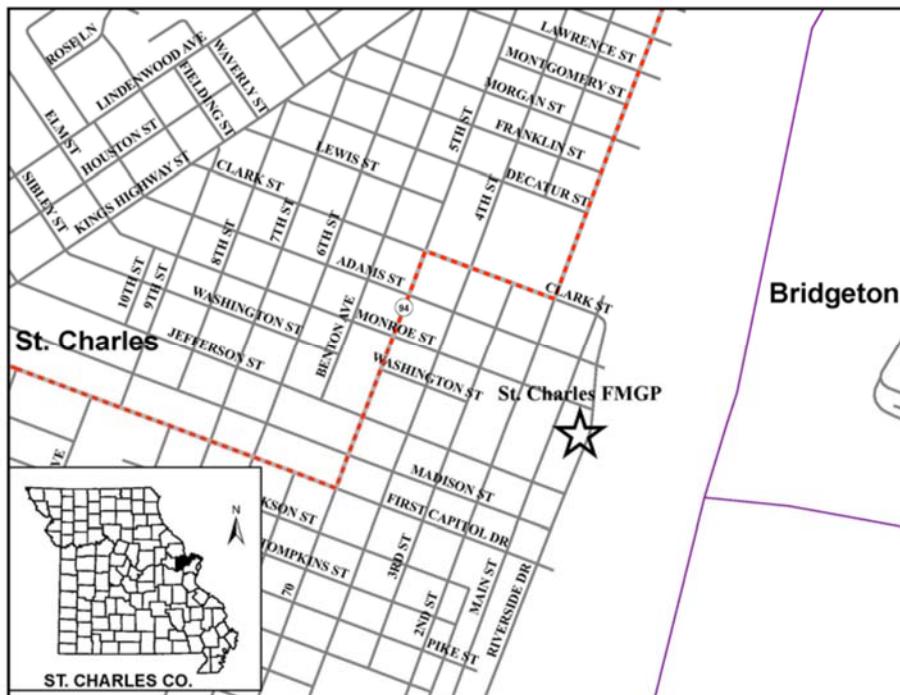
remains in the subsurface, it is recommended that follow-up groundwater sampling continue to be conducted in the release area to determine if a human health impact is present.

Excavation of subsurface soil potentially could expose construction and/or site workers to volatile organic compounds in soil and shallow groundwater. In addition, vapor intrusion may be an exposure concern for VOCs associated with activities at the Reichhold facility released to the soil and groundwater.

Based on available information, a potential health risk exists at this site due to the possibility of vapor intrusion.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

St. Charles FMGP



Site Name: St. Charles FMGP

Classification: Class 3

Date of Registry Placement: December 12, 2000

Site Address: Southwest corner of the intersection of North Riverside Drive and Monroe St., St. Charles, St. Charles County, Missouri

Present Property Owner: City of St. Charles

Lead Agency: Missouri Department of Natural Resources

Waste Type: Coal tar, which contains volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs)

Quantity: Not determined

Site Description: The St. Charles FMGP site, located in St. Charles' downtown historic district, is covered by an asphalt parking lot with no visual remains of the former manufactured gas plant (FMGP) structures. St. Charles Gas Works (1886, 1893, 1900), St. Charles Electric Light Works (1893, 1900), St. Charles Lighting Company (1909), St. Charles Lighting Company Gas Plant (1917),

and St. Charles Gas Company (1929) are all the various names the St. Charles FMGP site was identified as and appear on historic Sanborn Fire Insurance maps at the corner of Riverside Drive and Monroe Street, as early as 1886 to as late as 1929. The former manufactured gas plant structures included a 35,000-cubic-foot capacity gas holder, a 50,000-cubic-foot capacity gas holder, a purifying room, raiser, retorts, and various tar tanks. Structures from the past gas manufacturing facility may be partially intact beneath the site.

The site was identified as part of a comprehensive, statewide effort by the Department to locate former manufactured gas plants in Missouri and to evaluate the potential hazards posed by these sites. A Pre-Comprehensive Environmental Response, Compensation and Liability Information System Site Screening report was completed by the Department on March 30, 2000. Coal tar, a byproduct of the gas manufacturing process, is the primary waste of concern.

Environmental Problems and Areas of Concern:

Subsurface soil samples collected during the Site Screening investigation, from the approximate location of the former manufactured gas plant, contained VOCs and

PAHs at concentrations exceeding health-based screening levels. One sample contained leachable benzene that exceeded the Toxicity Characteristic Leaching Procedure regulatory limit, making this sample characteristic hazardous waste based on toxicity. The coal tar remaining in the subsurface may pose human health risks should any type of excavation or accidental uncovering occur in the future.

Remedial Action:

The Site Screening report concluded that the asphalt parking lot acts as a cap, protecting workers and other individuals from potential exposure that may result from subsurface contamination. Further assessment, including the use of additional equipment to penetrate on-site concrete, would compromise the integrity of an apparently effective cap. Such action was not recommended at the time of the Site Screening report, provided that institutional controls are in place and state oversight of future activities is ensured. Further sampling was recommended if the parking lot is ever removed.

The Fiscal Year 2018 annual inspection was completed by the Department on May 16, 2018. Some cracking and pot holes were noted in the asphalt parking lot throughout the site. A follow-up letter to the city will be sent to have them address the cracking and deterioration.

General Geologic and Hydrologic Setting:

The site lies on a west slope along the Missouri River at the edge of the 100-year flood plain. Approximately 10 feet of silty, sandy loam with moderate permeability lie beneath the site where not excavated or covered with fill.

Groundwater within the surficial materials recharges the Missouri River to the east. Precipitation has little chance of infiltrating the unconsolidated materials due to pavement and structures that cover the ground surface. Therefore, most water within the residuum originates from the Mississippian-age limestone hills to the west.

The Mississippian-age, finely-crystalline, 85-foot-thick St. Louis Limestone bedrock lies less than 10 feet deep. This limestone formation exhibits secondary dissolution

features that add to its permeability. Deeper strata include the 115-foot-thick, coarsely-crystalline Salem Limestone and the 115-foot-thick, fossiliferous limestone of the Warsaw Formation.

The deep bedrock aquifer is used in the local hills as a water source. However, due to the proximity of the site to the Missouri River, to which the aquifer discharges, the deep aquifer is not threatened.

Public Drinking Water Advisory:

The nearest public water well is located over 3 miles north of the site. Missouri American Water – St. Louis County/St. Charles County draws water from the Missouri River over 7 river-miles downstream from this site. No site-related impacts are expected.

Health Assessment:

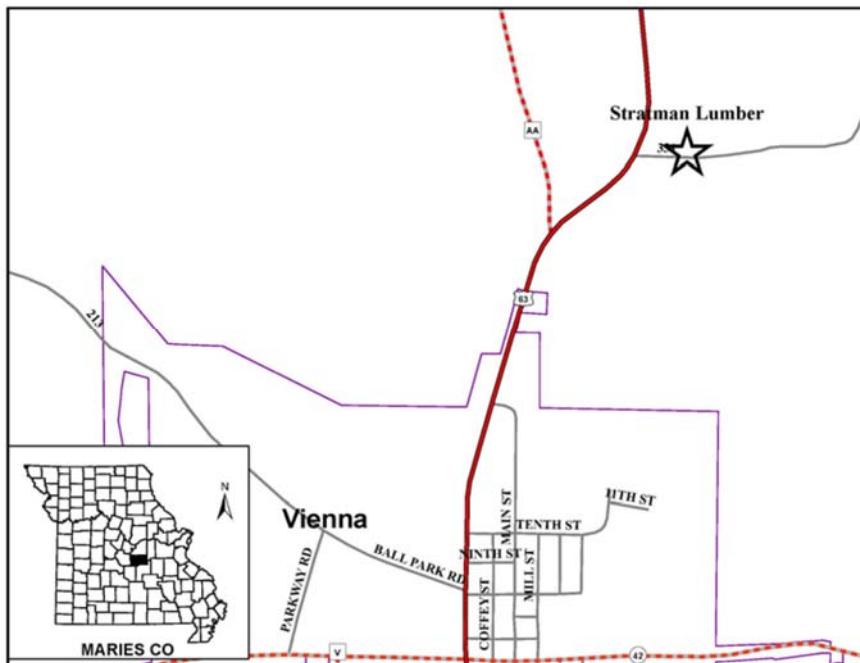
The chemicals of concern at this site include coal tar, which contains VOCs and SVOCs, including PAHs. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Little opportunity for human exposure exists because the site is covered by an asphalt parking lot. However, if the site is disturbed, site workers and nearby residents may be exposed to harmful levels of contaminants within subsurface soils through ingestion, dermal absorption, or inhalation of dust and vapors. It is not known whether groundwater is impacted; however, no private wells or other groundwater use has been identified.

Currently, no health risk is expected because exposure is not occurring. If site conditions change such that exposure to contaminated soils occurs, adverse health effects could occur.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Stratman Lumber



Site Name: Stratman Lumber

Classification: Class 3

Date of Registry Placement: November 22, 2000

Site Address: 0.1 miles east of the intersection of U.S. Highway 63 and County Road 331, north of Vienna, Maries County, Mo.

Present Property Owner: Mickey Jones

Lead Agency: U.S. Environmental Protection Agency (EPA)

Waste Type: Pentachlorophenol (PCP)

Quantity: Not determined

Site Description: The Stratman Lumber site is located in a rural area just north of Vienna. Mid-Mo Post and Lumber, Inc. (known locally as Stratman Lumber), was a wood treating facility that operated at the site from 1967 until 1979. The entire wood treating facility was originally eight acres.

Stratman Lumber purchased, treated, and sold wood posts and lumber of hardwood and softwood species. The wood treating operation was a vacuum system consisting of three tanks connected by piping: a treatment

tank where the wood was placed, a storage tank for the PCP, and an oil/water/impurity separator. Sometime in the 1960s, vandals reportedly trespassed on site and loosened bolts on the wood treating cylinder, allowing PCP to spill onto the ground.

A subsequent owner dismantled and moved the wood treating tanks, established a sawmill operation, built an office, and fenced off the property. This sawmill operated for approximately one year with about five workers. The sawmill operation ceased in 1995 due to the potential risk to workers from the historical contamination.

Environmental Problems and Areas of Concern:

PCP from wood treating processes is present at concentrations above health-based screening levels in subsurface soil. PCP wood treatment residuals are listed as an EPA hazardous waste F032. EPA designates PCP as a hazardous substance, hazardous waste, and priority toxic pollutant.

Surface water has been impacted by the site. Two documented fish kills have occurred as a result of runoff from the site. With the removal of highly-contaminated soil, further environmental impacts from this pathway would not be expected.

Remedial Action:

The Missouri Department of Natural Resources conducted a Removal Site Evaluation in 1997, to determine the extent of PCP contaminated soil. Analytical results from soil samples documented that an area of 4,440 square feet was contaminated with PCP to a depth of three feet. The contaminated area consists of a 10,000-gallon PCP storage tank near the eastern edge of the PCP contamination. The tank contained approximately 1,532 gallons of an oily liquid as of the August 5, 1997, Removal Site Evaluation sampling event.

On July 16, 1999, Ecology & Environment, Inc. (E&E), a contractor for EPA, delineated 110, 14- by 14-foot cells around the contaminated area. Results from the July 1999 sampling events and previous Department sampling identified 19 cells exceeding the site removal action level of 220 parts per million PCP. PCP was detected at concentrations up to 5,920 parts per million.

Starting November 1999, 19 cells were excavated to depths of contamination determined from previous sampling. Following excavation activities, further analytical data identified PCP contamination above the site action level in 11 cells. These 11 cells were further excavated until sampling confirmed that PCP contamination levels were below the site action level. The excavated cells were then back filled with clean soil. E&E began tank cleaning activities following the excavation of all soil cells. The remaining 360 gallons of liquid and 5,197 pounds of sludge contained in the tank were drummed and shipped for disposal, and the interior was steam cleaned with a power washer and degreaser solutions. A wipe sample of the interior was screened with results indicating PCP levels below 10 parts per million.

The Removal Action was completed December 6, 1999. All known areas of PCP soil contamination exceeding the 220 parts per million site action level were addressed by this removal action. However, soil containing PCP with concentrations exceeding residential health-based screening levels remains on site. Therefore, the site will remain on the Registry. The Department completed the Fiscal Year 2018 Registry annual inspection April 26, 2018, and noted nothing of significance.

General Geologic and Hydrologic Setting:

The site is located within the Salem Plateau, part of the Ozark Plateau of the Interior Highlands Physiographic Province. It is situated on a ridge near the divide between the Maries and Gasconade rivers. The site encompasses the divide between two small tributaries to the Gasconade River. The southern part is within the Indian Creek drainage. The northern part drains toward Crumb Creek. The site is located about 1.9 miles west of and 285 feet higher in elevation than the Gasconade River.

The site is underlain by the Jefferson City Dolomite, a medium- to finely-crystalline dolomite. The lithology is variable and includes thin beds of clayey dolomite, brecciated chert, shale, and occasionally sandstone. The Jefferson City Dolomite is covered by less than 10 feet of surficial materials, consisting of very little soil present over the thin cherty residuum. The bedrock below the site is not karst.

The Ordovician-age Jefferson City Dolomite is part of the Ozark Aquifer, which is the principal aquifer of the Salem Plateau region. In addition to the Jefferson City Dolomite, the Ozark Aquifer is composed of the Ordovician-age Roubidoux Formation and Gasconade Dolomite and the Cambrian-age Eminence Dolomite and Potosi Dolomite. The total thickness of the Ozark Aquifer at this site is expected to be 1,000 feet.

Residential wells obtain water from the Ordovician-age formations, and the city of Vienna public drinking water well extends into the Potosi Dolomite. The depth to the regional water table is expected to be in the range of 100 to 150 feet below the ground surface. The direction of groundwater flow is unknown. Because of the low vertical permeability of the Jefferson City Dolomite, perched water may be encountered at the top of unweathered bedrock. The Ozark Aquifer is probably not at significant risk of contamination from the site.

Public Drinking Water Advisory:

The city of Vienna draws water from the Ozark aquifer from two deep-rock wells located approximately 0.7 miles and 1 mile south of this site. In response to detection of PCP in one of the city's wells, the system began quarterly monitoring, but no additional

detections were recognized, and the wells returned to annual monitoring in 2013. Due to groundwater contamination in the area (unrelated to this site) and to potential migration of PCP from this site, monitoring data from the city of Vienna's well should be closely scrutinized to identify any potential increases in contaminant concentrations that may affect its wells.

Health Assessment:

PCP is the major contaminant of concern at this site. The PCP used to treat lumber at the site may have been technical grade PCP. Technical grade PCP routinely contained contaminants including tri- and tetrachlorophenol, hexachlorobenzene, polychlorinated dibenzo-p-dioxins, and polychlorinated dibenzofurans. Due to the presence of contaminants, the toxicity of PCP is difficult to assess. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with PCP.

The health concerns involve exposure to contaminated soil, surface water, and groundwater. PCP remains in soil at concentrations up to 220 parts per million. While this value is protective of the casual trespasser, it is not protective enough to allow residential development and is marginal for industrial use. Leaching of PCP to groundwater may also occur.

In 1994, both the Department and the Missouri Department of Health and Senior Services sampled private wells in the vicinity for metals and organic compounds. Both copper and zinc were detected during the sampling event. The presence of copper was attributed to background sources while zinc was site-related. The detected levels of metals were below unsafe levels for drinking water. No PCP was found in any of the samples.

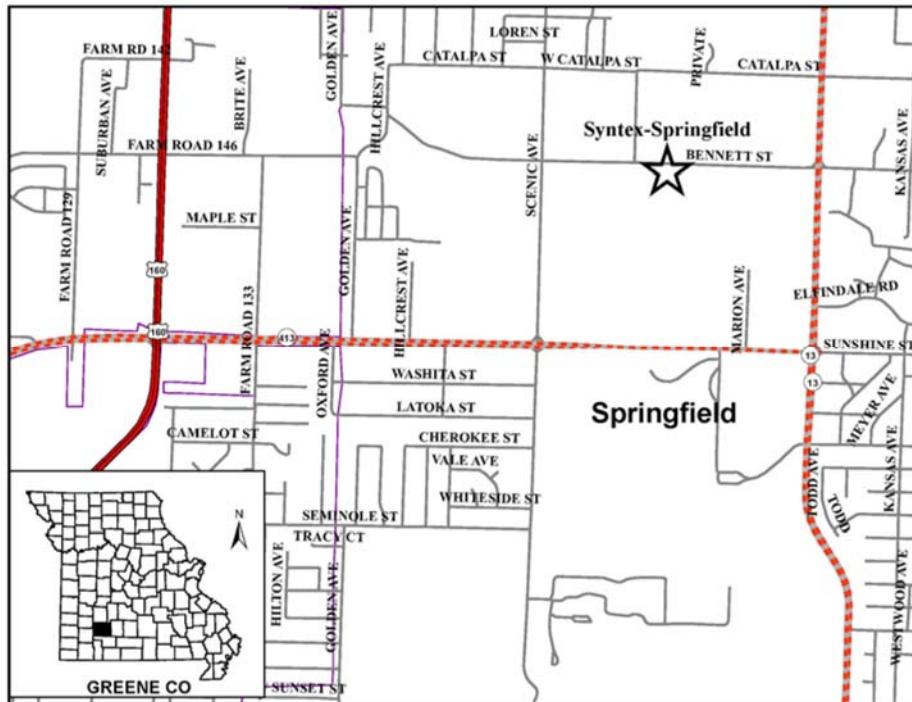
In 2008, the Missouri Department of Health and Senior Services sampled two private water supplies adjacent to the site for PCP, which was not detected in either well. One private water supply remains on site, but was not sampled. A non-community public water supply serving the shooting range on County Road 331 also was not sampled. According to one landowner, a spring is located within one mile northeast of the site.

Potential exposure may arise from direct contact with residual contamination in surface soils and dust. Exposure from pathways including volatilization of PCP to indoor air and ambient air are not expected to be significant because of the site remediation, the potential for breakdown of PCP in surface soils, and the limited volatility of PCP. Unless excavation of deeper soils occurs, visitors and workers should not be exposed to subsurface soil contamination.

Based on available information, the contaminants at the Stratman Lumber site present a potential health threat to the general public. The fact that PCP remains in soil presents a potential on-site risk due to direct exposure to soils and an off-site risk due to migration of contaminants in groundwater. The Missouri Department of Health and Senior Services therefore recommends that contact with the contaminated soils by workers and visitors to the commercial property be kept infrequent, and restricted only to non-invasive activities. Prior to further development of the site, additional soil testing should be performed. Follow-up sampling of the on-site well, a non-community public water supply serving a shooting range on County Road 331, and a spring that might be located within one mile northeast of the site is recommended to reassess off-site migration and exposure to contaminants.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Syntex - Springfield



Site Name: Syntex – Springfield (Euticals Inc./Archimica)

Classification: Class 3

Date of Registry Placement: January 1, 1984

Site Address: 2460 W. Bennett St., Springfield, Greene County, Mo.

Present Property Owner: Euticals Inc.

Lead Agency: Missouri Department of Natural Resources

Waste Type: Volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

Quantity: Not determined

Site Description: This site is an active chemical manufacturing facility. Currently, the site is fenced with 24-hour security. Hazardous wastes generated by past plant processes were managed in a surface impoundment at the facility. The impoundment was operated from the late 1950s until the early 1970s as a settling pond in conjunction with on-site wastewater treatment. The impoundment was then used for management

of hazardous wastes from the early 1970s until 1982 when it was decommissioned.

In 1975, the facility completed partial closure of the southern portion of the impoundment, by filling it with native soil, rock, and concrete. An interim hazardous waste concrete storage pad was then constructed on top of the closed portion. The remainder of the impoundment was physically closed in 1985, under a closure plan approved by the Department.

Environmental Problems and Areas of Concern:

The primary environmental problems are hazardous wastes and constituents that were released from the former surface impoundment.

Residual dense non-aqueous phase liquid is present in soil and bedrock, and contaminated aqueous phase liquid is present in the alluvial and upper bedrock zones. The vertical and horizontal extent of dense non-aqueous phase liquid and aqueous phase liquid contamination has been determined.

The site is located in the flood plain at the confluence of Fassnight, Jordan, and Wilson creeks, which gives it high priority because of the extent of contamination and potential threat to public health and the environment.

Jordan Creek runs along the eastern edge of the site joining Fassnight Creek at the southern site boundary to form Wilson Creek. The Department sampled water from Wilson Creek and area drinking water wells. Results of these analyses showed no contamination attributable to releases at the facility. In addition, Euticals, Inc. (Euticals) has sampled Wilson, Jordan, and Fassnight creeks and found no contamination attributable to releases at the facility.

Remedial Actions:

In September 1983, Syntex alerted the Department and EPA that various site investigation and groundwater monitoring activities confirmed the release of hazardous wastes to soil and groundwater from the surface impoundment. On September 14, 1983, the Department issued an emergency directive to Syntex requiring the company to: (1) immediately install a portable water treatment system; (2) immediately eliminate all discharges of wastewater into the impoundment; (3) immediately install aboveground, lined containment tanks; (4) pump water from the impoundment through the portable water treatment system; and (5) sample the treated water and report the results to the Department.

Syntex implemented the emergency directive. Water was removed from the impoundment and treated. After analysis showed the treatment was effective, the treated water was discharged into the Springfield sewer system. A concentrated sludge remained on the bottom of the lagoon.

On September 20, 1983, the Department issued an order to Syntex requiring the company to submit to the Department and EPA a closure plan for the surface impoundment and a remedial action plan for cleanup of contamination in the alluvium and groundwater. The order also required installation of new monitoring wells at the facility to better determine the extent of contamination. Following the Department's review, the closure and remedial action plans were approved July 6, 1984.

Syntex initiated steps to close the surface impoundment by treating contaminated water, stabilizing and excavating contaminated sludge, and placing the contaminated solids in a large reinforced concrete storage area

permitted under the Resource Conservation and Recovery Act. In 1988, the stored solids were removed from the storage tank and incinerated at the Denney Farm site.

Following the initial stabilization and removal of contaminated soil and sludge, verification sampling was performed to ensure adequate solids removal; a french drain was installed in the floor area of the impoundment; and the remainder of the impoundment was filled with clean, compacted clay and capped with gravel. The impoundment was then covered with an engineered concrete cap.

Syntex operated under a Department-approved post-closure plan due to the hazardous waste constituents left in place. The plan required continued groundwater monitoring for previous releases from the former impoundment. In addition, Syntex addressed further investigation, monitoring, and remediation of groundwater and soil contamination at the facility under the terms of a Resource Conservation and Recovery Act Corrective Action Order on Consent. This order was negotiated between Syntex and EPA. Syntex completed a Resource Conservation and Recovery Act facility investigation work plan that was approved by EPA and the Department. The scope of the Resource Conservation and Recovery Act facility investigation included the following: (1) characterize the potential pathways of contaminant migration; (2) characterize the source(s) of contamination; (3) define the degree and extent of contamination; (4) identify actual or potential receptors; and (5) support and develop or refine the corrective measures.

Syntex's 1996 Resource Conservation and Recovery Act facility investigation demonstrated that contaminated groundwater is captured by pumping wells, and contamination is confined within the facility property boundary. Euticals sampled Wilson, Jordan, and Fassnight creeks in 2005, 2006, 2008, 2011, and 2012 and found no contamination attributable to releases at the facility. As part of the final remedy, Euticals is required to periodically sample the nearby creeks.

In late 1996, the facility initiated the Corrective Measures Study. In January 2002, the facility submitted a final Corrective Measures Study Report to the Department and EPA, identifying and evaluating potential remedial alternatives.

In March 2005, the Department and EPA approved the final report. On September 30, 2010, the Department and EPA issued a final remedy decision and also issued final hazardous waste permits to Euticals. The Department issued the final Missouri Hazardous Waste Management Facility Part I Permit. EPA issued the draft Hazardous and Solid Waste Amendments Part II Permit. The hazardous waste permits require Euticals to conduct corrective action activities to ensure that the contaminant plume does not pose a threat to human health or the environment. The final hazardous waste permits outline the final remedy, which includes enhanced institutional controls, dense non-aqueous phase liquid recovery, surface water monitoring of creeks, groundwater containment and monitoring, and continued monitoring and maintenance of the closed, capped former surface impoundment.

Surface water is being monitored at three chemical monitoring locations at Jordan Creek Upstream, Fassnight Creek Upstream, and Wilson Creek Downstream. There are 64 groundwater monitoring wells at Euticals and a french drain. Thirteen wells monitor the alluvial (A) zone at 0-25 feet below ground surface, 19 wells monitor the weathered, karstic portion of the upper Burlington zone (WB1) at 25-80 feet below ground surface, and three wells monitor the contact between the A and WB1 zones. In addition, seven wells monitor the upper Burlington formation (UB1) at 50-80 feet below ground surface, five monitor the middle Burlington formation (B2) at 140-155 feet below ground surface, and seven monitor the contact between the UB1 and B2 zones. Five wells monitor the lower Burlington and Upper Elsey (E) zones at 200-220 feet below ground surface, and five wells monitor the Pierson (P) zone wells at 260-280 feet below ground surface. Thirty of these wells are sampled for groundwater contaminants including four A zone wells, eighteen B1 zone wells, six B2 zone wells, one E zone well, and one P zone well. In August 2012, Euticals installed three dense non-aqueous phase liquid recovery wells as part of final remedy implementation. Contaminated groundwater is recovered via six extraction wells and the french drain. The groundwater is now treated in Euticals' water treatment plant, which consists of phase separators, a holding tank, a cartridge filter, and an air stripper. The treated water is then

stored in holding tanks, tested, and released to Springfield city sewers.

Continued operation and maintenance of the final remedy is regulated under the Missouri Hazardous Waste Management Facility Part 1 Permit. A draft Environmental Covenant and an Operation, Maintenance, and Monitoring Plan are under review by the Department.

The final permits also outline the options that will be pursued in the event that the contaminated groundwater poses a threat due to significant off-site or vertical movement. The Department is the lead agency for corrective actions through a corrective action transition plan with EPA. The Department completed the Fiscal Year 2018 Registry annual inspection April 4, 2018, and noted nothing of significance.

General Geologic and Hydrologic Setting:

The site is located on the flood plain of Jordan Creek near its junction with Fassnight Creek.

The unconsolidated surficial materials at the site consist of 5 to 16 feet of fill material composed of silty, gravelly clay with minor amounts of sand. The fill is underlain by 0.5 to 20 feet of silty clay alluvium containing interspersed sand and gravel zones. Permeability of the alluvium varies based upon composition, with highest permeability in the sand and gravel zones.

Groundwater generally occurs at eight to 15 feet below ground surface within the fill and alluvium. The direction of groundwater flow within the alluvium is generally toward Jordan Creek. Fassnight and Jordan creeks, which become Wilson Creek at their confluence, appear to be gaining streams in the vicinity of the site.

Bedrock immediately underlying the alluvium is the Mississippian-age Burlington-Keokuk Limestone. The cherty limestone extends to a depth of approximately 280 feet to the top of the Northview Formation. Regionally, the Northview Formation is considered to be a confining layer that separates the shallow Mississippian-age limestones from the deeper Ordovician-age dolomites and sandstones.

The facility installed monitoring wells in several different horizons within the alluvium

and limestone bedrock. Water level information from these wells indicates a good hydraulic connection between the alluvial sediments and the upper shallow bedrock. Water levels in wells installed in deeper horizons of the shallow bedrock aquifer indicate a poor or very poor connection. These wells have significantly lower water levels and very low yields. These facts, together with the pumping test data, suggest that low-permeability zones exist in the lower part of the shallow bedrock.

Both the alluvium and the shallow bedrock aquifer have been affected by contamination. Because contaminants have been observed in several of the deeper monitoring wells, it can be assumed that downward migration of contaminants has taken place.

Public Drinking Water Advisory:

The city of Springfield uses groundwater and surface water as a primary source of drinking water. Site-related contamination is unlikely to influence the surface water sources, and the groundwater wells are deep wells that draw from the lower Ozark aquifer. A low-permeability layer of shale lies between the shallow Springfield Plateau aquifer and the deeper Ozark aquifer in this region. Although there are areas where mixing between the shallow and deep aquifers are known to occur, the city of Springfield's wells are not expected to be impacted by site-related contamination. The closest public water well to this site belongs to a motor lodge located approximately 1.5 miles west of the site. This system uses an old well that predates modern well construction standards and has a very shallow casing that likely allows the well to draw water from both the shallow and deep aquifers. Given the karstic nature of the shallow aquifer, this well may be particularly vulnerable to shallow subsurface or surface contamination from this or other sites in the area.

Health Assessment:

The following are the major contaminants of concern found at the site: acetone, benzene, bromochloromethane, chloroform, chloromethane (methyl chloride), 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, 1,2-dichloroethane, 1,2-dichloropropane, ethylbenzene, methylene chloride, 2-

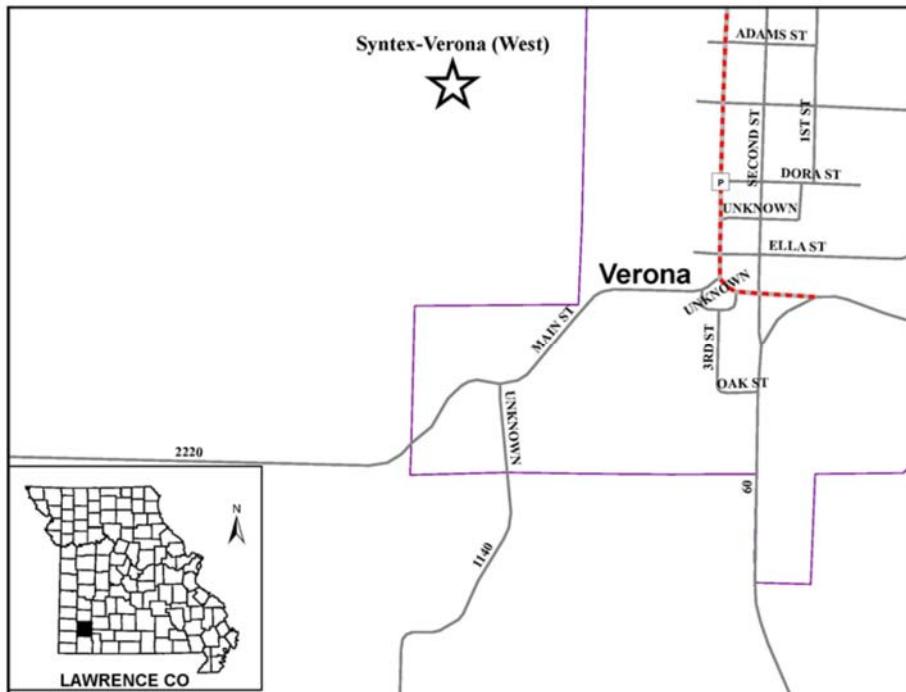
Methylnaphthalene, phenol, TCDD, toluene, trichloroethene, vinyl chloride, xylenes, arsenic, barium, and nickel. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Ingestion and direct contact are the primary routes of exposure since chemicals have leached into groundwater. If chemical fumes are inhaled or if a chemical is ingested, it can be harmful; however, that has been deemed highly unlikely in this area due to lack of public wells and the chemicals' unlikelihood of transportation to area springs. The plume is contained on site.

Currently, no detectable exposure to hazardous chemicals is occurring from the site, but the possibility exists for future exposure.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Syntex - Verona (West)



Site Name: Syntex - Verona (West)

Classification: Class 3

Date of Registry Placement: January 1, 1984

Date of National Priorities List Listing: September 8, 1983

Site Address: 299 Extension Street, Verona, Lawrence County, Mo.

Present Property Owner: Syntex Agribusiness, Inc.

Lead Agency: U.S. Environmental Protection Agency

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

Quantity: Not determined

Site Description: The Syntex - Verona (West) site consists of 77.85 acres of undeveloped land west of the Spring River near Verona, Missouri. The site is part of the larger Syntex Facility Superfund site listed on EPA's National Priorities List. In 2002, at the request of the property owners, the Syntex Facility Superfund site was divided into two separate sites for purposes of the Missouri

Registry: The Syntex - Verona (West) site and the Syntex - Verona (East) site. The Syntex - Verona (East) site is where Northeastern Pharmaceutical and Chemical Company (NEPACCO) formerly leased a building to manufacture hexachlorophene and produced TCDD as an unwanted byproduct. That property is located east of the Spring River and currently is owned by BCP Ingredients, Inc. (BCP). The Syntex - Verona (West) site is owned by Syntex Agribusiness, Inc. (Syntex) and is west of the Spring River. For remediation and regulatory purposes, the two properties are still treated as one site.

The Syntex - Verona (West) site contains buried waste materials (Trench Area), some of which are contaminated with TCDD. The site was remediated by Syntex with oversight from EPA. In September 1998, the soils portion of the site received a completion letter from EPA.

Environmental Problems and Areas of Concern:

The main area of concern on the site is the Trench Area, where manufacturing wastes, primarily consisting of non-hazardous solid wastes, were placed in five trenches excavated in the soil eight to twelve feet deep, and then covered. The Trench Area is approximately 1.3 acres in size. With the oversight of EPA, numerous investigations in

and around the trenches were conducted to delineate the nature and extent of chemicals of concern. TCDD exceeding 20 parts per billion in soil remains buried at the Trench Area. EPA's 2017 Fifth Five-Year Review Report recommended additional investigations continue to further evaluate the protectiveness of the current remedy as implemented for the Trench Area.

Remedial Actions:

The Trench Area was remediated by constructing a clay cap to promote drainage away from the trenches. Topsoil subsequently was placed on the cap, and vegetative cover was established and is being maintained. In addition, Syntex installed an upgradient gravel trench to divert storm water away from the trenches. Syntex installed groundwater monitoring wells to monitor groundwater quality at the Trench Area.

Syntex sold an uncontaminated 80-acre tract west of the trenches. The company retained the required buffer area and established permanent survey markers around the site as required by *Registry* law. A fence and warning signs restricting access also are present around the Trench Area. Syntex continues to operate a monitoring system for shallow groundwater downgradient of the Trench Area. Contaminants are not known to be leaving the site.

In September 2017, EPA completed the Fifth Five-Year Review and noted that based on available data, protectiveness of the remedies for soil and groundwater could not be determined. EPA recommended continued investigation at the site for both soil and groundwater to assess whether remedies remain protective. The Missouri Department of Natural Resources conducted the Fiscal Year 2018 annual inspection on April 10, 2018. Nothing of significance was noted; the inspection found the soil cap to be in satisfactory condition, and the site remained in compliance with applicable institutional controls.

General Geologic and Hydrologic Setting:

The site is located in an upland area not subject to flooding by the Spring River. Soil beneath the Trench Area and in the surrounding upland area consists of cherty silt and clay that overlies bedrock and ranges

from about 40 to 60 feet thick. Shallow groundwater occurs at or near the soil/bedrock interface, approximately 30 feet below the bottom of the trenches.

Two bedrock aquifers are present at the site: the shallow Mississippian limestone aquifer called the Springfield Plateau Aquifer, and a deeper aquifer made up of Cambrian- and Ordovician-age carbonates and sandstones called the Ozark Aquifer.

The Springfield Plateau Aquifer is made up of cherty limestones that directly underlie the surficial materials. This aquifer supplies limited yields to shallow wells and is subject to contamination from local sources, such as septic tanks and agricultural runoff, either through permeable soil and bedrock or through poorly-cased wells.

The Ozark Aquifer, present typically at depths greater than 300 to 400 feet, is used to supply major industrial and municipal users and individual landowners in the area. In general, the Ozark Aquifer in this region of the state has not been affected greatly by surface contamination; however, some localized pollution has resulted because of poorly-cased deep wells penetrating both the upper and lower aquifers.

Public Drinking Water Advisory:

The closest public water well to this site lies about 0.5 miles east of the City of Verona and serves a small subdivision. The well is cased 360 feet, draws from the deep Ozark aquifer, and site-related impacts are unlikely. The combined Aurora-Verona public water system also uses deep wells to draw water from the Ozark aquifer, but the closest well to this site is over 2 miles east-northeast from this site. No impacts are expected.

Health Assessment:

TCDD is the chemical of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

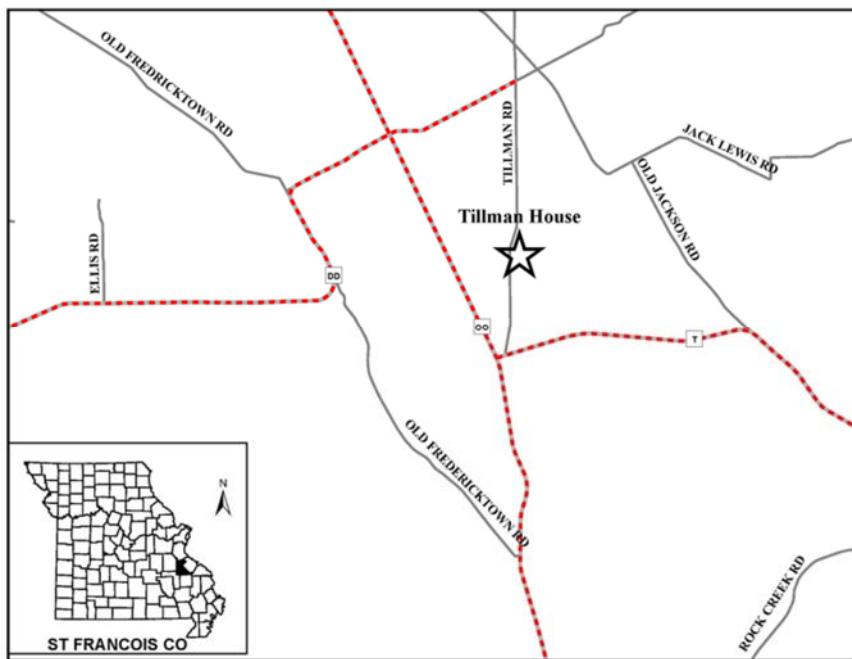
Potential routes of exposure include direct exposure to the contaminated soil or inhalation of contaminated dust. Overland access to the Trench Area is possible, but property boundaries are fenced and posted

“No Trespassing – Restricted Area.” Syntex has improved roadways at the site. A majority of the roads are now paved with asphalt and others have a crushed rock cap. These improvements allow safer access to monitoring wells and eliminate disturbance of surface soils. The outline of the Trench Area cap is marked, posted and surrounded by a barbed-wire fence. Access along the Spring River is limited by heavy vegetation. Waste materials are capped as outlined above and are not exposed. Shallow groundwater at the site is not accessible. Fish in the Spring River are considered safe to eat because sampling has shown that TCDD levels are below levels of health concern.

Based on available information, it cannot be determined whether a threat to public health exists. Remedial activities approved by EPA were implemented to mitigate potential site risks. The continued site investigation and reassessment discussed in the Fifth Five-Year Review will more accurately determine remaining site risk and whether additional remedial action is necessary for the site remedy to be protective of human health and the environment.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Tillman House



Site Name: Tillman House

Classification: Class 3

Date of Registry Placement: September 24, 2001

Site Address: Tillman Road near Highway OO and T, approximately 9 miles south of Farmington, St. Francois County, Mo.

Present Property Owner: Douglas Beard & Allison Barrett

Lead Agency: Missouri Department of Natural Resources

Waste Type: Volatile organic compounds (VOCs)

Quantity: Not determined

Site Description: The site is the location of the former North American Airborne Allergens, Inc. (NAAA), which used tetrachloroethene (PCE) and acetone in the processing of pollens for pharmaceutical use from 1975 until 1989. During operations, PCE and acetone were burned with trash and were spilled on site.

The site occupies 15 acres in a rural area. An unnamed intermittent stream flows through the center of the property and enters the Little

St. Francis River at the northwest corner. The site is used as a residence with several structures, including the historic Tillman House, a foundation from the former Weidert house, and a metal shed. In January 2013, Douglas Beard and Allison Barrett bought the property from the Clubb's. They reside in the Old Tillman House on the north side of the property.

Environmental Problems and Areas of Concern:

Soil, ground- and surface water were contaminated with PCE. The spilled PCE, designated as an EPA hazardous waste U210, was detected in ground- and surface water at concentrations up to 1,640 parts per billion. Trichloroethene (TCE) is present in groundwater at concentrations up to 81.9 parts per billion.

Potential exposure to contaminated water in the stream remains a concern; one surface water sample documented PCE at 774 parts per billion and TCE at 9.6 parts per billion in 1999.

Remedial Action:

An EPA contractor conducted a 1996 Preliminary Assessment/Site Inspection investigation and recommended a removal action due to the presence of PCE and TCE

in the on-site private drinking water well (Weidert well) above the maximum contaminant level of 5 parts per billion. To address this contamination, the EPA installed a carbon filtration system for the drinking water well. PCE also was detected in soil samples.

The Weidert well was constructed in 1941, according to the former property owner, Mr. Lindell Clubb. It was approximately 200 feet deep and only cased 10 feet down. In 1998, Mr. Clubb had a new well drilled to serve his home (the Old Tillman Historic house). It was drilled to a total depth of 307 feet and had 80 feet of casing. This well was tested by the Missouri Department of Health and Senior Services in 2007, 2009, and 2011, and no VOCs have been detected above the maximum contaminant level.

In 1999, the Department conducted a Site Reassessment investigation because the Missouri Department of Health and Senior Services samples from the old Weidert well were showing TCE levels above the maximum contaminant level after the carbon filtration system. It was determined this was due to the fact that the filter had never been changed or replaced. Surface water in the pool of the on-site intermittent stream and at the confluence of the intermittent stream and the Little St. Francis River was sampled during this investigation. The surface water was found to contain PCE still above the maximum contaminant level and Missouri Water Quality Standards benchmarks. However, concentrations decreased to below levels of concern approximately 250 feet downstream of the confluence with the Little St. Francis River.

On October 2005, Mr. Clubb had another well drilled on the southern part of the property for his son. It was drilled to 287 feet and had 80 feet of casing. It is located approximately 300 feet west of the old Weidert well. The Missouri Department of Health and Senior Services tested this new well five times starting in 2006. The first results detected PCE at 4.8 parts per billion November 2006. When sampled again April 2007, results detected PCE at 1.2 parts per billion. The last three tests in May 2008, August 2009, and November 2011, had no VOCs detected.

The Department recommended that the old contaminated Weidert well be properly closed

and abandoned since it was no longer being used. By doing this, it would cut off the route of exposure to contaminated drinking water and most likely eliminate a contaminant pathway to deeper groundwater. In August 2011, the Department's Wellhead Protection Section oversaw the proper closure of the Weidert well. No further remedial actions have occurred. The Department completed the Fiscal Year 2018 Registry annual inspection April 27, 2018, and noted nothing of significance.

General Geologic and Hydrologic Setting:

The site, located on the eastern fringe of the Salem Plateau portion of the Ozark Plateau physiographic province, is situated on a gently rolling surface. An intermittent creek crosses the site from the east to the northwest where it enters the Little St. Francis River immediately.

The site is underlain by the Cambrian-age Bonneterre Formation, which is composed of dolomite, characterized by a pinnacled erosional surface, and overlain by about 10 feet of silt and silty clay (loess) and clayey materials. Examples of minor karst, such as losing streams, seeps, and springs, have been reported near the site. Large joints (bedrock fractures) observed in bedrock exposed in the Little St. Francis River may be related to underlying geologic structures (Libertyville Graben) and more distant northwest/southeast trending fault zones.

The Cambrian-age Bonneterre Formation and the underlying Lamotte Sandstone form the St. Francois Aquifer. In areas like the eastern part of the Ozark province, adjacent to the east side of the St. Francois Mountains groundwater province (also the recharge area for the St. Francois Aquifer), the St. Francois Aquifer is the only local source of groundwater available and therefore important. The water table likely is about 10 feet below the ground surface near the contact between soil and bedrock. The direction of groundwater flow may be controlled by joints but likely is generally toward the northwest with discharge occurring to the Little St. Francis River.

The intermittent creek, which crosses the site, enters the westward flowing Little St. Francis River. The Little St. Francis River continues to flow to the west then turns south where it joins the St. Francis River. The St. Francis River eventually empties into the Mississippi River

in eastern Arkansas.

Public Drinking Water Advisory:

No public water sources within 5 miles of this site, and no impacts are expected.

Health Assessment:

Contaminants found at the site include PCE, acetone, TCE, and 1,2-dichloroethene. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Missouri Department of Health and Senior Services sampled private drinking water wells in the nearby vicinity in 2004 and 2012 and did not find any of them to be impacted by volatile organic chemicals.

Based on available information, surface water could be a source of exposure to the contamination. The last sampling of the creek was completed in 1999 by the Department. Until new sampling of the creek can be completed, it is unknown if the creek is still contaminated.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Todd Site



Site Name: Todd Site

Classification: Class 3

Date of Registry Placement: June 2, 1987

Site Address: 701 Lynch St., St. Louis, Mo.

Present Property Owner: Anheuser-Busch Companies, Inc.

Lead Agency: Missouri Department of Natural Resources

Waste Type: Stoddard solvent

Quantity: A total of 26 underground tanks and eight 55-gallon drums, containing 54,405 gallons of liquids and sludges and 4,236 cubic yards of contaminated soil, were removed from the site during remediation.

Site Description: The site, now a paved parking lot, is located in downtown St. Louis. A commercial laundry and dry-cleaning business operated on the site until 1980, where they used Stoddard solvent stored in underground tanks. Anheuser-Busch Companies Inc. (ABC) purchased the property in 1980 and in 1983, razed the buildings and paved the site for use as a parking lot.

Environmental Problems and Areas of Concern:

Following remedial actions, residual contamination remains in the soil and groundwater. Contamination may be migrating off site via groundwater. Groundwater locally is not used for drinking.

Remedial Actions:

Sampling and analyses of the underground tanks indicated the presence of Stoddard solvent, which possesses the characteristic of an ignitable hazardous waste. On October 7, 1983, five groundwater monitoring wells were installed. Analyses of groundwater samples collected from these wells showed the presence of Stoddard solvent downgradient from tanks at the west side of the site. This contaminant was not detected in groundwater samples collected upgradient from those tanks. The Department notified ABC of its intention to include the Todd site on the Registry February 6, 1984. ABC appealed the proposed Registry action March 2, 1984.

On May 25, 1984, the Department issued ABC a Notice of Order to Clean up Hazardous Substance (Order No. HC84-003). Anheuser-Busch was required by the Department to implement a Department-approved Remedial Action Plan. The Remedial Action Plan

addressed three areas of the Todd site: west side, the Todd building area, and the dry cleaning area.

Environmental Science and Engineering, Inc. (ESE) excavated eighteen tanks and contaminated soil around these tanks from the west side (Area 1) of the site. ESE found two tanks that contained diesel oils and sludges, while the remaining tanks contained Stoddard solvent, sludge, or contaminated soil. The liquid wastes contained in the eighteen tanks were shipped by ESE to an off-site hazardous waste landfill for solidification and land disposal. The tanks and 4,236 cubic yards of contaminated soil were shipped off site by ESE for landfilling.

Soil sample results from the excavated pit ranged between 20 and 11,000 parts per million for Stoddard solvent. The excavated area was filled by ESE with clean soil.

The Todd building area (Area 2) contained seven underground tanks. Area 2 was located at the corner of Lynch and Seventh streets. The liquid contents of these tanks (essentially Stoddard solvent) were shipped off site for recycling by ESE. ESE shipped sludge contained in the tanks to an off-site hazardous waste landfill for disposal. Five of the empty tanks were cleaned and filled with grout by ESE, while two tanks were excavated and shipped to a landfill.

The dry-cleaning area (Area 3), immediately north of the Todd building, consisted of a sump containing gravel, solvents, and water, and a large tank containing solvents and water. The tank was pumped out, cleaned, and filled with sand by ESE. ESE shipped the solvents from the sump and tank off site for recycling, while the sludge was sent off site for disposal in a hazardous waste landfill. Eight 55-gallon drums of dry-cleaning sludge were also shipped off site for landfill disposal by ESE. Following these actions, ESE collected samples from the five monitoring wells, which showed the presence of Stoddard solvent in downgradient wells at concentrations of up to 32.3 parts per million. The recommended water cleanup level was 2.3 parts per million. In addition, sample analyses confirmed the presence of a top layer of Stoddard solvent in a third monitoring well. A sample collected from this well December 10, 1984, contained a layer of Stoddard solvent with a 1,3,5-trimethylbenzene concentration of 10,000

parts per million. The five monitoring wells were sealed by ESE during construction of the parking lot on the west side. ESE installed two new groundwater monitoring wells subsequently.

General Geologic and Hydrologic Setting:

The site is located on a moderate slope, which forms the western edge of the Mississippi River alluvial plain. The site is covered by fill material consisting of firm, brown, silty clay, intermixed with construction rubble. The fill, which is generally between 3.5 and 4.5 feet thick, is underlain by silty clay.

The bedrock unit beneath the site is Mississippian-age St. Louis Limestone, a medium- to massively- bedded, fine-grained limestone that is greater than 100 feet thick. The St. Louis Limestone contains well-developed karst features. Solutioning of fractures and bedding planes has rendered the bedrock highly permeable. Beneath the St. Louis Limestone is more than 700 feet of Mississippian, Silurian, and Devonian bedrock, predominantly limestone, which forms the uppermost bedrock aquifer. The Ordovician-age Maquoketa Shale separates the upper, freshwater aquifer from the saline water of deeper Ordovician and Cambrian formations.

Shallow soil-exploration borings drilled on the site indicate some free water at about 15 feet below the surface. This water is thought to be perched on top of one of the moderate- to low-permeability, silty, clay deposits. The direction of movement of the perched water is unknown.

The water table elevation at the site is also unknown, but is estimated to be 40 to 50 feet below the ground surface. The general direction of shallow groundwater movement is expected to be eastwardly towards the Mississippi River, which serves as a regional discharge point. The rate of groundwater movement should be slow to moderate in the soil horizons and rapid in the bedrock.

Groundwater is not used generally as a water supply source in St. Louis because surface water supplies have been well-developed. However, wells have been drilled by various drilling companies in the downtown area, and some of these may still be in use.

Public Drinking Water Advisory:

The city of St. Louis draws water from the Mississippi and Missouri rivers, with intakes located several miles upstream from this site. No public water sources in the vicinity use groundwater. No site-related impacts are expected.

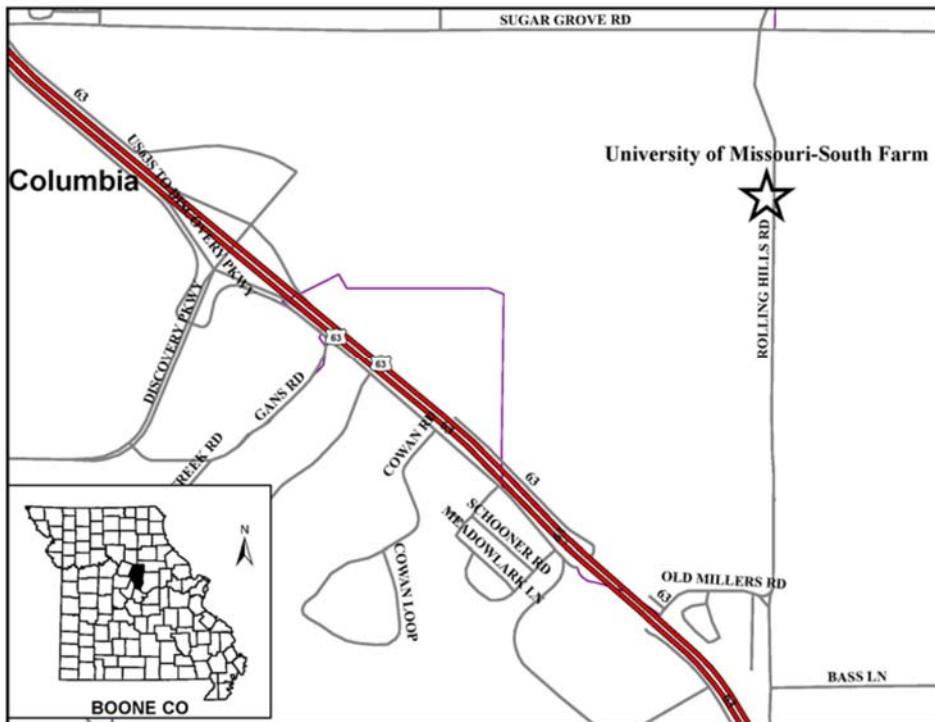
Health Assessment:

The chemical of concern at this site is Stoddard solvent. The chemical composition of a typical Stoddard solvent is 30 to 50 percent paraffins, 30 to 40 percent cycloparaffins, and 10 to 20 percent aromatic hydrocarbons. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant. At present, the risk to public health is minimal, as groundwater in this area is unsuitable for drinking purposes.

Based on available information, a potential health risk remains at the site due to the known concentrations of the contaminants in the soil and water. Current risks are low as long as the area remains paved, and the groundwater is not being used for drinking.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

University of Missouri - South Farm



Site Name: University of Missouri - South Farm

Classification: Class 3

Date of Registry Placement: January 1, 1984

Site Address: Along Rolling Hills Road, southeast of Columbia, Boone County, Mo., NE 1/4, SE 1/4, NW 1/4, Sec. 34, T. 48N, R. 12W, Columbia Quadrangle

Present Property Owner: University of Missouri

Lead Agency: Missouri Department of Natural Resources

Waste Type: Laboratory wastes, waste solvents, farm chemicals, and radioactive waste

Quantity: Undetermined amounts of waste, because wastes were subject to open burning and only residues remain

Site Description: The site is located in the University of Missouri-Columbia's research farm south of Columbia. The site was used by the University to burn and bury pesticide and other chemical wastes and containers from

the Farm's operations and campus laboratories from 1967-1978. The residues from this process were buried on site in a series of trenches. The site is about 20 feet from a rural paved road. Although the site was located in rural Boone County at the time of disposal, recent development has made the site part of a rural residential area. No homes are immediately adjacent to the site; however, a house is located within 0.1 mile from the site.

The area used for hazardous waste disposal is fenced, capped, and vegetated. The University maintains fencing and signage surrounding the burial area.

Environmental Problems and Areas of Concern:

Burned wastes, contaminated soil, and shallow groundwater contamination are concerns.

Remedial Actions:

The entire farm is fenced to limit public access, and the disposal site is also fenced to prevent access by livestock. Signs identifying the site as a "Chemical Disposal Area" and warning "Keep Out" are on the gate and the fence.

In 1991, the Department completed a Site Inspection. The Site Inspection concluded hazardous substances were present in the buried trenches and shallow groundwater contamination was occurring. The chemicals 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) were detected in water samples taken from the on-site borings.

In 1997, the University applied to the Department's Brownfields/Voluntary Cleanup Program to further characterize the site and determine the need for remediation or monitoring. In 2000, the University installed three new bedrock monitoring wells and additional overburden wells to assess migration of the wastes from the burial site. Quarterly groundwater monitoring was conducted through early 2002 to establish a baseline and observe trends in groundwater quality.

Surface water and sediment samples collected from Gans Creek showed no detectable contaminants discharging to the creek. Surface soil samples collected from the burial area showed no detectable contaminants. Shallow groundwater samples from temporary monitoring points contained 13 volatile organic compounds (VOCs) such as dichloroethane, benzene, chlorobenzene, and chloroform. Lower levels of 17 VOCs and chlorinated herbicides were found in shallow bedrock monitoring wells at water level depths of 13 to 37 feet below ground. The solvent 1,4-dioxane was the only detected contaminant in the farthest downgradient well, closest to Gans Creek. Due to its solubility and mobility, 1,4-dioxane would be expected to migrate more quickly than the other contaminants. At this time, there is no evidence that the contaminants are reaching any receptors, including Gans Creek, or drinking water wells in the area.

In 2013, the University began new investigations of soil and groundwater. Soil and buried waste samples were collected by means of soil borings and exploratory trenches. Water samples were collected from Gans Creek. Several new monitoring wells were installed, and some wells were abandoned and replaced to better assess the groundwater plume. Quarterly sampling of all wells was conducted through July 2015. The Department received a report on the investigation in December 2015. New soil data

helped to better characterize concentrations of pesticides, solvents, and metals at the site. Surface soil was confirmed to be minimally contaminated within the fenced burial area. A wide range of chemicals were detected at part per million levels in subsurface soil around and within the waste trenches, but no large deposits of chemical wastes were found. No detections were found in the Gans Creek samples.

Groundwater data indicated the plume extends approximately 300 feet from the burial area and remains contained to the area between the burial site along Rolling Hills Road and Gans Creek to the northwest. The plume does not appear to be affecting Gans Creek.

The report recommended the plume be contained so as to prevent further migration to the north and west of the burial site. In 2017, the Department requested the University perform feasibility studies for containment or removal of the burial area, and that studies be done to evaluate the treatability of the groundwater plume. With Department's support, the University is exploring the use of the site as a laboratory for both research and educational purposes in multi-disciplinary areas of environmental science and engineering.

General Geologic and Hydrologic Setting:

The site is located on a west-facing, moderately gentle slope. Gans Creek, which occupies the valley downslope, flows to the southwest and through Rock Bridge Memorial State Park. It eventually merges with Clear Creek to form the Little Bonne Femme Creek, which then enters the Missouri River.

The soil underlying the site consists of a relatively thin layer of silt and silty clay of glacial origin. The total soil thickness above bedrock is estimated to be 8 to 20 feet.

Bedrock in the immediate vicinity is composed of Pennsylvanian-age cyclic deposits of sandstone, siltstone, shale, underclay, limestone, and coal. This bedrock, which is expected to be 20 to 40 feet thick, probably has low permeability.

Groundwater is obtained from two major bedrock aquifers in this area. The shallow bedrock aquifer, composed of Mississippian

limestones, underlies the Pennsylvanian bedrock and provides low yields to private wells. The deep aquifer, composed of Cambrian- and Ordovician-age carbonates and sandstones, is isolated from the shallow aquifer by a thin layer of Devonian limestone, which acts as a "leaky" confining unit. The deeper aquifer is used as a source of public water supply and for other uses that require high yields. Poorly-cased wells may provide an avenue for downward migration for contaminants.

The low permeability of the glacial soil and overall low permeability of the Pennsylvanian bedrock are expected to prevent deep groundwater from being affected. Shallow, perched groundwater possibly exists in the glacial soil or at the top of the bedrock. Perched water is expected to move horizontally, reappearing downslope and potentially affecting surface water in the Gans Creek watershed.

Public Drinking Water Advisory:

Consolidated Public Water Supply District #1 of Boone County uses a deep well located approximately 1.1 miles south-southwest of this site. This well is cased over 300 feet deep and is not likely to be impacted by site-related contamination.

Health Assessment:

The University burned and buried a wide variety of chemicals including pesticides, hydrocarbon and chlorinated solvents, laboratory chemicals, and low-level radioactive wastes (C-14 and tritium) at the site. Due to the large number of chemicals involved, it is difficult to provide a comprehensive list of specific health effects. Many of the chemicals can cause both cancer and non-cancer health effects.

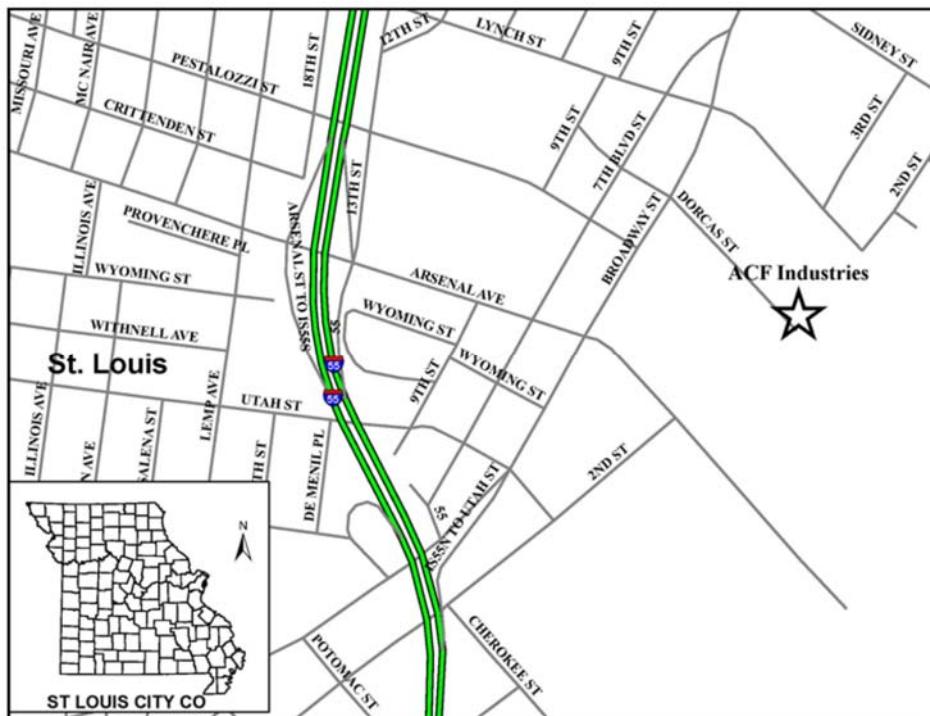
Exposure is only likely to occur through ingestion of contaminated groundwater. Residential development of land adjacent to the site is occurring at an increasing rate. However, no residences for a distance of three miles are known to use groundwater for drinking water. Public water is available for the area surrounding this site. No evidence of groundwater use near the site has been discovered during site visits. The entire area that was used for waste disposal is now capped. Most of the site is well vegetated. As

long as the cap is maintained, contact with contaminated soil is not considered a potential route of exposure.

Sampling on-site subsurface soils, surface soil, and groundwater showed detections of pesticides, solvents, and metals. Although the groundwater contamination plume remains on site, the geologic and hydrologic setting at the site makes it possible for the migration of contaminated groundwater to move downslope and potentially affect the surface water of the Gans Creek watershed. Based on available information, this site represents a possible human health threat, with on-site workers being at greatest risk, although no exposure is known to exist at this time.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

CLASS 4 SITES



Site Name: ACF (American Car Foundry)

Classification: Class 4

Date of Registry Placement: February 22, 1985

Site Address: Dorcas and Second Street (2800 DeKalb St.) and a portion of City Block 769, St. Louis, Mo.

Present Property Owner: Anheuser-Busch Companies (ABC)

Lead Agency: Missouri Department of Natural Resources

Waste Type: Volatile organic compounds (VOCs)

Quantity: An estimated 12,230 gallons of solvent had been spilled over a 36-year period. Following remediation, residual contamination remained in the soil subsurface and shallow groundwater.

Site Description:

The site was a railroad car manufacturing facility where solvents were spilled as part of ACF's operations cleaning paint from stencils. ACF spilled an estimated 12,230 gallons of

solvents on the ground over the lifetime of this operation. Today, the site is covered by an asphalt parking lot.

The site is in an industrially-zoned area of St. Louis. Although the site is fenced, it is accessible to the public via a roadway. The nearest off-site building lies 300 feet to the west. About 18 industrial buildings are located within 1,000 feet of the former stencil cleaning area.

Environmental Problems and Areas of Concern:

Residual levels of contamination remain in the soil subsurface and shallow groundwater. Prior to the cleanup, contamination migrated through the soil into the groundwater.

The site is located in the recharge area of the Mississippi River, which is 0.25 miles to the east. Groundwater in this area is not used for drinking water or agricultural purposes, but groundwater movement is toward the Mississippi River.

Remedial Action:

In 1981, EPA identified the site as the result of a Comprehensive Environmental Response, Compensation, and Liability Act notification. In

September 1983, ACF Industries Inc. conducted the field assessment of the stencil-cleaning area and recommended removal of the contaminated soil.

In March 1984, ACF implemented a Department-approved remedial action plan for site cleanup. A total of 1,530 cubic yards of contaminated material was removed from the site, which removed an estimated 90 to 95 percent of the solvents. ACF backfilled the excavation with clay, which covered up the remaining contaminated soil. Backfilling of the excavation was completed April 1984. As excavated sections were closed, ACF collected samples. After final closure, analytical results showed residual levels of solvents still present in the soil subsurface and in the shallow groundwater. The remediation report concluded that the cost of removing the residual contamination was economically prohibitive.

In 1985, ACF transferred the property title to Yellow Freight Systems Inc. of Delaware. On April 9, 1987, the Department approved a request by Yellow Freight for the demolition of structures on the property and pavement of portions of the property. No excavation occurred in the contaminated area of the property. In January 1991, Yellow Freight Systems re-surveyed the site, to reduce the Registry-listed area to be only the contaminated area and the required 100 foot buffer zone. Yellow Freight filed this new surveyed area, approved by the Department, with St. Louis City Recorder's Office.

In 1999, ABC purchased the site from Yellow Freight Systems Inc. In March 1999, ABC enrolled the site in the Department's Brownfields/Voluntary Cleanup Program. ABC performed soil and groundwater investigations and limited response actions under Department oversight. ABC's consultant removed a previously undiscovered underground solvent storage tank and placed soil and an asphalt cap over the contaminated area. Residual solvent contamination of subsurface soil and shallow groundwater remains. ABC placed a restrictive covenant in the property chain of title restricting use of the property to industrial uses and requiring maintenance of the cap. The Department issued a certification of completion February 2001. The Department completed the Fiscal Year 2018 Registry annual inspection April 20, 2018, and noted nothing of significance.

General Geologic and Hydrologic Setting:

The site is located on the Mississippi River flood plain 0.25 mile from the Mississippi River.

Soils are composed of artificial fill and alluvium. The alluvium at the surface is generally composed of fine-grained clay and silt. Coarse-grained alluvium, composed principally of sand, is expected at depth. The water table is relatively shallow (10 to 20 feet), but varies somewhat with river stage.

Because the spill area is located in an industrialized area downstream from the railroad terminal, it is possible that contaminants unrelated to this particular spill are present in the groundwater at the site. Materials that have remained following cleanup activities at this site eventually will migrate through the alluvium into the Mississippi River. The rate of movement of contaminants through the shallow groundwater system is expected to be relatively low, and a number of years may pass before the plume reaches the river.

Public Drinking Water Advisory:

The City of St. Louis obtains raw water from the Missouri and Mississippi rivers, but all intakes are upstream from this site. No impacts are expected.

Health Assessment:

Trichloroethene (TCE), tetrachloroethylene, methylene chloride, dichloroethene, benzene, toluene, and xylene were present in groundwater and soil samples collected from the site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Remedial action by ACF reduced the concentrations of the contaminants in the soil to levels below risk-based limits with the exception of TCE. However, subsurface soil and shallow groundwater at this site still contain contaminants at levels that could cause adverse health effects. Potential health risks are low because the area of contamination is covered with asphalt and fenced, and the contaminated groundwater has not been found to be a part of any aquifer used for drinking water. As long as the

restrictive covenant on the site is honored, the site should not present a public health risk.

Due to closure of the plant, if transfer of the property to private ownership is proposed, disturbance of the pits or development of private wells on or adjacent to the site may pose an increased risk to public health.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

A. P. Green



Site Name: A. P. Green

Classification: Class 4

Date of Registry Placement: June 14, 1984

Site Address: Green Boulevard, Mexico, Audrain County, Missouri, Vandalia Quadrangle. The site is made up of six individual waste dumps with the following location descriptions:

- (1) Waste Dump No. 2, SW 1/4, SE 1/4, Sec. 31, T. 51N, R. 8W
- (2) Waste Dump No. 4, SW 1/4, SE 1/4, Sec. 31, T. 51N, R. 8W and portions of NW 1/4, NE 1/4, Sec. 6, T. 50N, R.W
- (3) Dynamite Dump No. 5, N 1/2, NE 1/4, Sec. 6, T. 50N, R. 8W
- (4) Waste Dump No. 6, NE 1/4, NW 1/4, Sec. 6, T. 50N, R. 8W
- (5) Waste Dump No. 7, SE 1/4, NW 1/4, and portions of the SW 1/4, NE 1/4, portions of NW 1/4, SE 1/4, and portions of NE 1/4, SW 1/4, Sec. 6, T.N, R. 8W
- (6) Waste Dump No. 8, NW 1/4, SW 1/4, Sec. 31, T. 51N, R. 8W

Present Property Owner: Environmental Liability Transfer

Lead Agency: Missouri Department of Natural Resources

Class 4 Sites

Waste Type: Dynamite (nitroglycerine) and cyanide-containing heat-treating compounds

Quantity: Estimated 5,000 pounds of dynamite and undetermined quantity of cyanide compounds remain buried on site

Site Description:

The A.P. Green Site consists of six separate clay mining pits associated with the former A.P. Green Fire Brick Company. A.P. Green originally mined the six pits, designated WD#2, WD#4, WD#5, WD#6, WD#7, and WD#8, to provide clay for the production of refractory bricks. Records indicate that prior to 1981, the pits were used by A.P. Green for waste disposal. A.P. Green disposed of heat treatment wastes, possibly containing cyanide and totaling about 150 gallons, in five of the six pits. About 5,000 pounds of dynamite (nitroglycerine) were deposited in the sixth pit (WD#8). Pit WD#7 was also part of a permitted demolition landfill. Two additional waste dump pits associated with A.P. Green operations are located in the same area, but are not listed on the *Registry* because they are not known to have received hazardous wastes; one received asbestos and another metal piping used for acid transfer.

The closest residence is 1,300 feet from WD#7. The nearest commercial or industrial

area is 0.5 mile north of WD#8. A publicly-traveled area is 800 feet away (US Highway 54), and a public use area is 0.5 mile from the site (Teal Lake Park).

Use of the land directly adjacent each waste dump pit is limited to seasonal hunting and occasional recreation. Portions of the parcels containing the pits also are used as farmland.

Access to the parcels containing the pits is restricted by a gated fence, but access to the individual parcels is not further limited. The property is posted with warning signs. An old guardhouse at the main A.P. Green Fire Brick Company entrance is currently not staffed.

Environmental Problems and Areas of Concern:

The buried dynamite in WD#8 is the primary concern at this site. Dynamite is composed of nitroglycerine, sorbents (such as clay), and stabilizer compounds. Since the dynamite was buried in unlined pits and covered with clay soil, infiltrating rainwater may have come into contact with it. Department staff observed water pooling on top of WD#8 during a 1992 site inspection. During the most recent 2018 inspection, Department staff again observed significant surface water pooling on top of WD#5 and WD#7. Due to the regional geology, potential migration of contaminated groundwater from the pits is not expected to be significant. However, the stability or explosive life of the buried dynamite is unknown. Worker injury, fire, or explosion could occur if the waste is disturbed. Numerous ponds and streams are in the area. The pits are sparsely vegetated, and some gully erosion has been observed near waste pit WD#7.

Remedial Actions:

In 1981, the Department conducted a Comprehensive Environmental Response, Compensation, and Liability Act Site Inspection. The pits already had been covered with soil at that time. The Department concluded in the Site Inspection report that the risks posed by the site were low. The primary potential risk was identified as disturbance of the buried wastes. No further investigation or remedial action has occurred at the site. Following *Registry* notification in 1986, the

property owner submitted a legal survey to reduce the size of the property appearing on the *Registry*. Survey markers were installed at the corners of the six contaminated pits, including a 100-foot buffer zone in all directions.

The Department conducts annual site inspections to document site conditions and verify that no significant change in property use occurred. During the most recent inspection conducted on March 7, 2018, Department staff noted the presence of pooled surface water on pits WD#5 and WD#7, erosional gullies forming at pit WD#7, and missing and damaged signage at some of the pits. Several of the survey markers outlining the pit boundaries could not be located.

General Geologic and Hydrologic Setting:

The sites are located in an upland setting. Glacial till, about 100 feet in thickness, overlies Pennsylvanian-age bedrock. Both the surficial material and the bedrock are characterized by low permeability.

Shallow groundwater is present in the glacial till, though yields are generally low. The approximate location of the water table is at the contact between the surficial material and the bedrock. Groundwater found at this depth is normally highly mineralized and as such does not meet drinking water standards.

Due to the low permeability of the surficial material, numerous ponds exist in the area. In addition, clay pits in the area retain water, creating artificial ponds. Streams in this region tend to be gaining.

Groundwater supplies are not anticipated to be affected significantly by site contamination. However, surface water may be affected by leakage reaching Long Branch Creek to the east, or South Fork of the Salt River to the west.

Public Drinking Water Advisory:

The closest public water well to this site belongs to the Missouri American Water – Mexico district, but is located over 2 miles west of this site. This well, and other wells belonging to the system, are cased over 400 feet deep and draw from the northern margin

of the Ozark aquifer. No impacts are expected.

Health Assessment:

The chemicals of concern include cyanide and nitroglycerine. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

The parcels where the individual pits are located are restricted from public use, and the materials are buried at depths from 6 to 40 feet. The Missouri Department of Health and Senior Services concluded that, because of the massive deposits of clay surrounding and underlying the site, the potential for off-site migration of the chemicals through groundwater movement is very small. WD#7, used for disposal of dynamite, exists within a high-voltage overhead electric line easement. This could pose a threat to persons performing work in the utility line easement should the work involve excavation. Otherwise, the only likely exposure to these chemicals appears to be if the wastes were disturbed or erosion were to occur. This could result in adverse health effects through ingestion or dermal absorption of contaminants by contact with buried waste or localized contaminated soil and groundwater.

Direct exposure to the contamination on site is unlikely to occur. A historical exposure investigation conducted by Missouri Department of Health and Senior Services found no evidence of human exposure to contaminants from the site.

Based on the information available, Missouri Department of Health and Senior Services has determined that this site does not currently pose a health hazard to the general population. Similarly, workers and trespassers on the site should not be at risk, provided the waste materials are not disturbed; however, it is recommended that the clay around the pits be maintained to reduce pooling and erosion.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, PO Box 570, Jefferson City, MO 65102, 573-751-6102.

ARMCO



Site Name: ARMCO

Classification: Class 4

Date of Registry Placement: January 1, 1984

Site Address: 7000 Winner Road, Kansas City, Jackson County, Mo. Portions of SW 1/4, Sec. 29; NW 1/4, Sec. 32; and NE 1/4, Sec. 31, T. 50N, R. 32W, Independence Quadrangle

Present Property Owner: Ross Custom Properties, LLC purchased portions of the property from the AK Steel Corporation west of I-435 on December 12, 2017. The Kansas City Port Authority purchased several parcels of the property from AK Steel Corporation on Feb. 27, 2018. The Kansas City Port Authority property is located on both the west and east sides of I-435. The remainder of the property is owned by The Andersons, Inc., Moly-Cop USA LLC, Blue Summit LLC, Planned Industrial Expansion Authority, and Hansen Property Development Inc. Registered and non-registered property owned by these companies composes the AK Steel facility under the Resource Conservation Recovery Act.

Lead Agency: U.S. Environmental Protection
Class 4 Sites

Agency

Waste Type: Lead, cadmium, and zinc in the Registry areas. Arsenic, cadmium, lead, volatile organic compounds, and semi-volatile organic compounds in non-Registry areas of the Resource Conservation and Recovery Act site.

Quantity: Approximately 27,000 tons remain in the Registry areas.

Site Description: The ARMCO complex is an inactive steel manufacturing plant. From 1962 to 1980, ARMCO disposed electric furnace baghouse dust generated from steel production processes in two landfills located on its property. Baghouse dust generated by ARMCO contained leachable quantities of lead and cadmium and a high concentration of zinc (10-12 percent). After 1980, this waste became regulated under the Resource Conservation and Recovery Act. Both landfill areas are listed on the Registry.

This site is located in an industrial area of Kansas City. Access to the site is restricted by fencing but is accessible by water via the Big Blue and Missouri rivers.

Environmental Problems and Areas of Concern:

The landfill areas are capped with three feet of

soil and a good vegetative cover. ARMCO conducted groundwater monitoring at the Resource Conservation and Recovery Act landfill under the Missouri Department of Natural Resources' Part 1 Missouri Hazardous Waste Management Facility Permit.

Groundwater monitoring indicated that contaminants were not leaching from the landfill. In 1998, the Department approved a permit modification to discontinue groundwater monitoring of the Resource Conservation and Recovery Act landfill.

Remedial Actions:

EPA's Hazardous and Solid Waste Amendment Part II Permit issued November 30, 1994 requires the permittee to conduct site wide corrective action. The Resource Conservation and Recovery Act landfill is permitted by the Department under a Part 1 Missouri Hazardous Waste Management Facility Permit. The Department is currently processing the Missouri Hazardous Waste Management Facility Part 1 Permit application for permit renewal. Any further investigation and remediation will be performed under the jurisdiction of the new permit. EPA's Part II Permit requires corrective action at twenty solid waste management units and four areas of concern. These units and areas of concern are on property currently owned by the Kansas City Port Authority, Ross Custom Properties, LLC, Blue Summit LLC, The Andersons Inc., Hansen Property Development Inc., and Planned Industrial Expansion Authority.

AK Steel Corporation conducted a Resource Conservation and Recovery Act facility investigation in 1999 and a supplemental Resource Conservation and Recovery Act facility investigation in 2008 to assess potential releases to the environment from the solid waste management units and areas of concern. EPA and the Department approved both documents February 3, 2009.

In 2013, AK Steel Corporation conducted an investigation of suspected historical mercury disposal at a former boiler house on the ARMCO Property. In March 2016, AK Steel Corporation removed and properly disposed of soil containing mercury.

The corporation prepared and submitted a final Corrective Measures Study Report for Solid Waste Management Units 2, 3, 4, 5, 6,

7, 12, 13, 17, 24, and 33 and Areas of Concern 1, 4, and 8 in 2015. EPA and the Department approved the document July 22, 2016.

AK Steel Corporation completed interim measures at Solid Waste Management Unit 33, Nail Mill Degreasing Area September 2017. Interim measures consisted of removing and properly disposing of soil containing trichloroethene. On December 6, 2017, AK Steel submitted a long-term monitoring plan consisting of groundwater monitoring at Solid Waste Management Unit 33. On July 10, 2018, EPA and the Department approved the document. The Department conducted the Fiscal Year 2018 annual inspection May 23, 2018 and noted nothing of significance.

General Geologic and Hydrologic Setting:

Surface soils are composed primarily of low-permeability, alluvial, silty clay, underlain by moderate-permeability alluvial silt and sand. Wastes were deposited in permeable materials within an abandoned meander of the Big Blue River at or below the water table. Groundwater monitoring at the RCRA landfill and the Old Blue River "W" landfill indicates that contaminants are not leaching from the landfills.

Depth to the water table ranges from 10 to 20 feet. Groundwater flow is toward the Big Blue and Missouri rivers. No known drinking water wells produce from the alluvial aquifer downgradient of the landfills.

Public Drinking Water Advisory:

No public water supplies are proximal to this site and impacts are not expected.

Health Assessment:

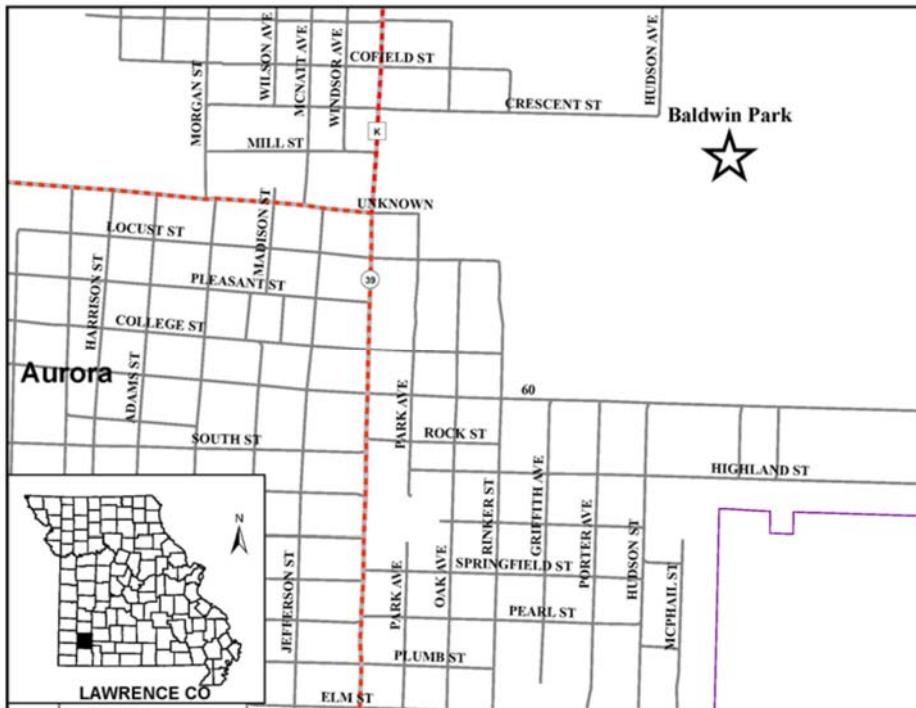
The chemicals of concern at this site include lead, cadmium, and zinc. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants. A previous exposure investigation conducted by the Missouri Department of Health and Senior Services documented no significant human exposure from this site. Access to the site is restricted.

The only release of contaminants from the site appears to be via surface runoff into the Blue

River. The Department and the U.S. Geological Survey conducted a study of storm water runoff into the Blue River basin. This study revealed that immediately following rainstorms in the lower Blue River basin, the level of zinc doubled between the upstream and downstream sampling points from Armco. This study also showed smaller increases in the lead concentration in the river at the downstream sampling site. Following heavy rainfall events, zinc and lead in the Big Blue River would be present in high concentrations in the suspended solids. As the suspended solids settle out, the lead and zinc in the deposited sediment would potentially be available to bioaccumulate in fish and other aquatic organisms.

Based on the contaminated surface water runoff into the Blue River, a potential health threat exists at this site through sediment and fish. A fish advisory is implemented on the Blue River for common carp and catfish of all sizes of one meal per month based on polychlorinated biphenols and chlordane detections; however, these advisories are not associated with this site. No site-related fish or sediment data are available at this time. For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Baldwin Park



Site Name: Baldwin Park

Classification: Class 4

Date of Registry Placement: September 23, 1986

Site Address: Baldwin Park is located on High Street in the extreme northeast corner of the town of Aurora, Lawrence County, Missouri, NE 1/4, Sec. 7, T. 26N, R.W, Aurora Quadrangle

Present Property Owner: City of Aurora

Lead Agency: Missouri Department of Natural Resources

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T), hexachlorophene, and lead

Quantity: Not determined

Site Description:

The site is now the location of a municipal park. Historically, the area was strip-mined for zinc ore. When mining operations ceased, the city of Aurora and surrounding communities used the pits as a dump for municipal trash. The EPA and the Department received reports that, in the mid-1960s, TCDD-contaminated

wastes generated by the Hoffman-Taff Corporation were buried at the site. Later sampling substantiated these reports. The dump was closed and capped in the 1970s, and the area was converted into a park.

Following a request by the city of Aurora to reduce the area listed on the *Registry*, additional sampling by environmental firms was conducted in July 1996, to delineate the area of contamination. TCDD was not detected in the northern and northeastern areas of the park. The area on the *Registry* was reduced to include only 60 acres in the park's southern portion.

Environmental Problems and Areas of Concern:

In 1987, under EPA and Department oversight, the dioxin-impacted portion of the site was partially cleaned up, capped and vegetated. The most heavily contaminated areas were cleaned to a TCDD level of 20 parts per billion or less. The capped areas are maintained by the city of Aurora in order to prevent erosion and human exposure. These areas are not specifically delineated, and no TCDD-related warning signs are posted. The remaining capped areas are located within the gun club area in the park's southwest corner, which is fenced. Ball fields are located to the northwest of the Registry area, and additional

future development is planned by the city of Aurora.

Remedial Actions:

In October 1983, EPA initiated investigations at Baldwin Park. Sample results indicated the presence of TCDD at concentrations ranging from 2.7 to 743 parts per billion, with the highest concentrations detected in discrete samples collected from exposed bags and drums. In November 1984, EPA conducted additional sampling to determine the extent of contamination. Groundwater wells and piezometers depicted that groundwater flow at the site is to the west to southwest.

In winter 1987, EPA contractors excavated and removed approximately 250 cubic yards of soil that exceeded 20 parts per billion TCDD. The contractors transported excavated soil to EPA's mobile incinerator in Verona, Missouri. The excavated areas and areas showing TCDD surface contamination between 1 and 20 ppb were covered and capped by the contractor. The cap consists of 6 inches of sand; a brightly-colored plastic liner that serves as an indicator if the cover is compromised; another 6 inches of sand; and 6 inches of topsoil. The topsoil was seeded and covered with a biodegradable erosion control mat. The city of Aurora agreed to provide maintenance and prevent excavation of the cover. To ensure that contaminated groundwater was not migrating off site, EPA monitored groundwater for one year.

In 2001, the Department conducted a Combined Preliminary Assessment/Site Investigation of the Lawrence County Mining Site, which revealed elevated levels of lead in several residential yards in the city of Aurora. As a result, EPA conducted a removal action in the area and excavated about 5,000 to 8,000 cubic yards of soil from residential yards.

In 2002, the Department approved the use of the Baldwin Park Site as a repository for lead-contaminated soils excavated during the Lawrence County Removal Action. The lead-contaminated soils were used in the construction of a berm, adjacent to the gun club on site, to reduce noise levels and shot hazards inherent with the club area's usage. The contractors began excavating soils and constructing the berm in July 2002, and completed the work in fall 2002. Surface soil

in the berm area contains lead at concentrations above EPA's residential action level of 400 parts per million. The contractors placed the lead-contaminated soil at the bottom of the berm structure, covered the lead contaminated soil with one foot of clean fill, and vegetated the soil cap to eliminate erosion and exposure potential. The city of Aurora has responsibility to maintain the berm. The berm area is fenced to restrict access.

In summer 2004, Department staff met with the city of Aurora's Parks and Recreation Department to discuss plans for Baldwin Park. The city envisioned a set of walking trails and possibly fishing in some of the subsidence ponds on site. The Department performed initial site assessment work in spring 2005. The work characterized the mining-impacted portions of the park. During the same time period, the University of Missouri was contracted to provide a final park plan. The park planning document included extensive development plans and detailed mapping of metals contamination. Department staff conducted additional sampling that confirmed fish obtained from the park ponds were safe for consumption.

Contractors began reclamation in January 2006 with the construction of perimeter fencing in an effort to prevent dumping and illegal vehicle use in the park. The city of Aurora received an EPA Brownfields Cleanup Grant in October 2007 to remediate soils impacted by former mining activity. In spring 2009, contractors removed vegetation and the top layer of contaminated soil. Contractors treated the remaining soil with high phosphate poultry litter in June 2009, to reduce metals toxicity. Following Missouri Department of Health and Senior Services recommendations, contractors capped areas with residual contamination with 1 foot of clean soil and/or 4 inches of crushed aggregate in September 2010. Contractors vegetated the capped areas with native plants. The Department conducts annual inspections of the Registry area to ensure the soil cap and vegetative cover remains in satisfactory condition.

In December 2010, the Department submitted the final Cleanup Grant Project Report to EPA. The city plans to develop hiking trails and a fishing pond in the project treatment area. The pond area was fenced by the city of

Aurora in 2011. To date, no additional development has occurred at the park. The Department conducted the Fiscal Year 2018 annual inspection on May 10, 2018. The inspection report noted nothing of significance.

General Geologic and Hydrologic Setting:

The Baldwin Park site is located on a broad, upland area characterized by very gentle slopes. The site straddles the drainage divide between the west-flowing Chat Creek and the north-flowing Elm Branch of Honey Creek.

Historically, this area has undergone some radical land-use changes that altered the site's natural features. The area near the railroad tracks reportedly was swampy at one time. However, as the area was settled, it was drained and converted to an apple orchard. In 1886, lead ore deposits were discovered, and subsequent surface and underground mining drastically altered the topography. The mining, which ceased in 1955, resulted in open shafts, pits, millworks, and tailings piles. Many of the mined areas have since been reclaimed. Some of the remaining open shafts and pits are now filled with water.

Exposures in mine shafts reveal about 20 feet of residuum derived from the weathering of underlying bedrock. The residuum is composed of reddish-brown, cherty, silty clay. Typically, this material develops a very blocky structure and exhibits high permeability. However, the residuum at the site seems to be atypical, as evidenced by the historically high water levels and swampy conditions.

The bedrock surface is uneven. The uppermost bedrock at the site is the Mississippian-age Burlington-Keokuk Limestone, except in the southern part of the park, where a relatively thin layer of sandstone, shales, conglomerates, and limestone cover the Burlington-Keokuk Limestone, along with underlying Mississippian-age cherty limestones, make up the shallow aquifer in this area. This aquifer is over 350 feet thick and is used extensively for individual rural water supplies.

A confining layer separates the shallow aquifer from the deeper Cambrian- and Ordovician-age carbonates and sandstones that make up the deep aquifer. The deep

aquifer is about 1,800 feet thick. Very high yields may be obtained from this aquifer. As a result, it provides public water supplies for the area.

Both Chat Creek and Elm Branch are gaining streams near the site, but lose water to the subsurface down gradient of the site. The lost water recharges the shallow aquifer, and some of it is later discharged from springs. Water tracing studies have shown that water lost to the subsurface in the Honey Creek drainage emerges at Big Spring near the mouth of Williams Creek.

Public Drinking Water Advisory:

The combined Aurora-Verona public water system uses several deep wells in the area for drinking water. The closest of these wells is just under one mile from this site, but is cased over 300 feet deep. A small drive-in about 0.7 miles southeast of the site uses one public water well that is only cased 165 feet deep and is likely open to both the shallow Springfield Plateau aquifer and the deep Ozark aquifer. Due to the relatively low permeability of soils in this area, site-related contamination is not likely.

Health Assessment:

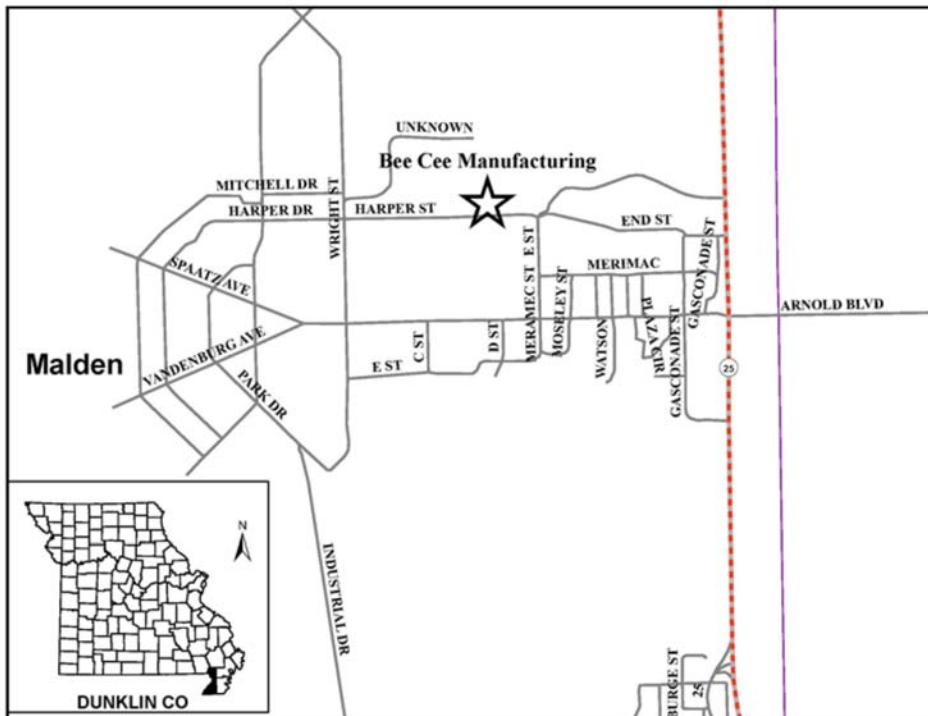
The contaminants of concern at this site are TCDD, 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T), hexachlorophene, and lead. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Since contamination does still exist, Missouri Department of Health and Senior Services recommends replacing warning signs around the area of contamination so they are visible to the public. Good hygiene practices, such as hand washing, can go a long way to reduce exposures. It is also recommended that any trails developed over areas with elevated lead levels continue to be covered with either mulch or gravel. As long as the cap remains intact, this site does not appear to present a significant health risk at this time. If site conditions were to change such that exposure to contaminated soil occurs, adverse health effects could result.

For more information regarding health-related issues, please contact the Missouri

Department of Health and Senior Services,
P. O. Box 570, Jefferson City, MO 65102,
573-751-6102.

Bee Cee Manufacturing



Site Name: Bee Cee Manufacturing

Classification: Class 4

Date of Registry Placement: July 8, 1988

Date of National Priorities List Listing:

June 10, 1986

Site Address: Falcon Drive, Malden Industrial Park, Malden, Dunklin County, Missouri, SE 1/4, Sec. 28, T. 23N, R. 10E, Malden Quadrangle

Present Property Owner: City of Malden

Lead Agency: Missouri Department of Natural Resources

Waste Type: Metal plating process wastewater, containing hexavalent chromium, aluminum, nickel, lead, and phosphate

Quantity: Not determined

Site Description:

From 1964 to 1983, Bee Cee Manufacturing Company (Bee Cee) manufactured aluminum storm windows and doors on this three-acre site in the city of Malden's Industrial Park. As part of its operations, Bee Cee treated

aluminum moldings to clean and etch the metal before applying a finish coat of paint. During the manufacturing process, Bee Cee dipped aluminum frames in a series of large vats that contained chemicals and rinse water. Bee Cee periodically dumped the contents of the vats onto the ground surface behind the building, where the untreated wastewater readily percolated into the sandy soil and contaminated the area's shallow groundwater. The untreated wastewater contained chromium, aluminum, nickel, lead, fluoride, and phosphates. The discharge visibly affected a 50- by 100-foot area behind the Bee Cee facility. In 1983, Bee Cee declared bankruptcy. EPA completed a removal action in 1992. During the action, EPA removed contaminated soil and other debris from the site. In addition to the contaminant removal, EPA also demolished and removed on-site abandoned buildings and established a vegetative cover over the removal area.

Environmental Problems and Areas of Concern:

The Bee Cee site is located in a permeable alluvial setting, where rapid movement of contaminants to the shallow groundwater aquifer is likely. Historical waste migration in the groundwater is the primary concern at this site, which is listed on EPA's National

Priorities List.

Remedial Actions:

After going bankrupt, Bee Cee abandoned five vats of aqueous industrial waste. Falcon Door & Window Company, a later occupant of the building, took responsibility for removing the vats. One of the five vats contained liquid hazardous waste. The contents of the other vats were not hazardous. On March 20, 1986, Falcon Door & Window Company removed the vat containing hazardous waste and properly disposed of the waste under full compliance with an administrative order. Falcon Door & Window Company also removed and properly disposed the other four vats of non-hazardous material.

EPA, the Missouri Department of Natural Resources, the Agency for Toxic Substances and Disease Registry, and the Missouri Department of Health and Senior Services developed soil action levels of 2,000 parts per million for total chromium and 180 parts per million for hexavalent chromium. In June 1993, EPA completed a further investigation of site's groundwater. EPA's investigation found a chromium-contaminated plume in excess of EPA's drinking water standard. No threat to public drinking water currently exists; however, a threat is posed to future use at the site.

In September 1997, EPA signed a Record of Decision formalizing the remedial measures in the proposed plan, which included natural attenuation and groundwater monitoring. In March 1999, the Department completed the remedial design. The site work primarily was federally funded, with the state taking the lead in performing the remedial work.

In 2010, EPA and the Department conducted soil sampling at the site and concluded that soil remains contaminated with hexavalent chromium above residential-use levels, but below industrial-use levels. The Department included an addendum to the site environmental covenant limiting future site use to industrial operations only, in addition to the restriction of groundwater use.

In June 2014, EPA and the Department finalized the third Five-Year Review report. The report recommended reevaluating the site groundwater cleanup level for hexavalent chromium if EPA updates the maximum

contaminant level, or after the site remediation goal for hexavalent chromium has been attained site-wide. The report recommended additional soil sampling be conducted on the site's west side to complement sampling conducted in 2010, to determine if additional risk from soils remains in that area. The report also recommended a screening-level ecological risk assessment be conducted, given that current methodologies were not used previously to assess ecological risk. The next Five-Year Review is scheduled to be completed in July 2019.

In August 2017, the Department conducted annual groundwater sampling and found that none of the site wells had detections of hexavalent chromium above the site remediation goal of 18 parts per billion. Total chromium for all site wells was below the site remediation goal of 100 parts per billion. This event was the fourth consecutive annual groundwater monitoring event in which both hexavalent and total chromium were below site remediation goals. The Department completed the Fiscal Year 2018 annual inspection on May 10, 2018. The inspection report noted nothing of significance.

General Geologic and Hydrologic Setting:

The Bee Cee site is located on the east edge of the Kennett-Malden Prairie, a low alluvial terrace that parallels Crowley's Ridge. Sand and gravel up to 150 feet thick underlie the site. The highly-permeable alluvium readily absorbs the vast majority of the precipitation that falls on the site. Surface runoff occurs only during intense rainfall.

Water and other fluids introduced onto the surface would be expected to move rapidly down to the water table, which is estimated to be 8 to 12 feet below the surface. The water table elevation changes seasonally on a regional scale and may be influenced locally by water supply wells and irrigation wells producing from the alluvium. The direction of groundwater movement in the alluvial aquifer is to the east-southeast.

The Wilcox Group, which consists of loosely-consolidated sands and clays, underlies the alluvium. Downward movement of contaminants is retarded by the uppermost clay layer in the Wilcox Group. Sandy intervals of the Wilcox Group may be used as a water supply, but generally are not because

the alluvial aquifer is shallower and of comparable quality.

The underlying McNairy aquifer, which is tapped by some of the Malden public supply wells, has a piezometric head above the ground surface, which means it is artesian. It is highly unlikely that contaminants from the Bee Cee site would affect this deep aquifer.

Public Drinking Water Advisory:

Three public water wells serving the City of Malden, New Madrid Co. and PWSD #5 are located less than 1 mile from the site. All three wells are deep wells cased at least 700 feet that draw from the McNairy aquifer, which is generally well protected from surface or shallow sub-surface contamination. No site-related impacts are expected.

Health Assessment:

The major contaminants of concern found at the site are: chromium, aluminum, nickel, lead, and phosphate. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Possible exposure pathways include the ingestion of contaminated groundwater, direct contact with contaminated soil, and inhalation of dust from contaminated soil. The contact and inhalation routes of exposure are expected to be a minor concern. The ingestion route could be a major concern if the contamination reached the city well; however, this is not expected, because the city well pulls its water from the deep aquifer that is isolated from the shallow aquifer by the relatively impermeable Porter Creek clay formation.

The area served by the Malden city water system has only a few isolated shallow wells. An initial analysis of these shallow wells and Malden City Well No. 4 showed nickel levels in a few shallow wells that were slightly above the recommended safe lifetime level. Subsequent rounds of testing on these same wells by the Missouri Department of Health and Senior Services show nickel levels below the recommended drinking water standard. Sampling of monitoring wells in the area should continue to ensure that no one is

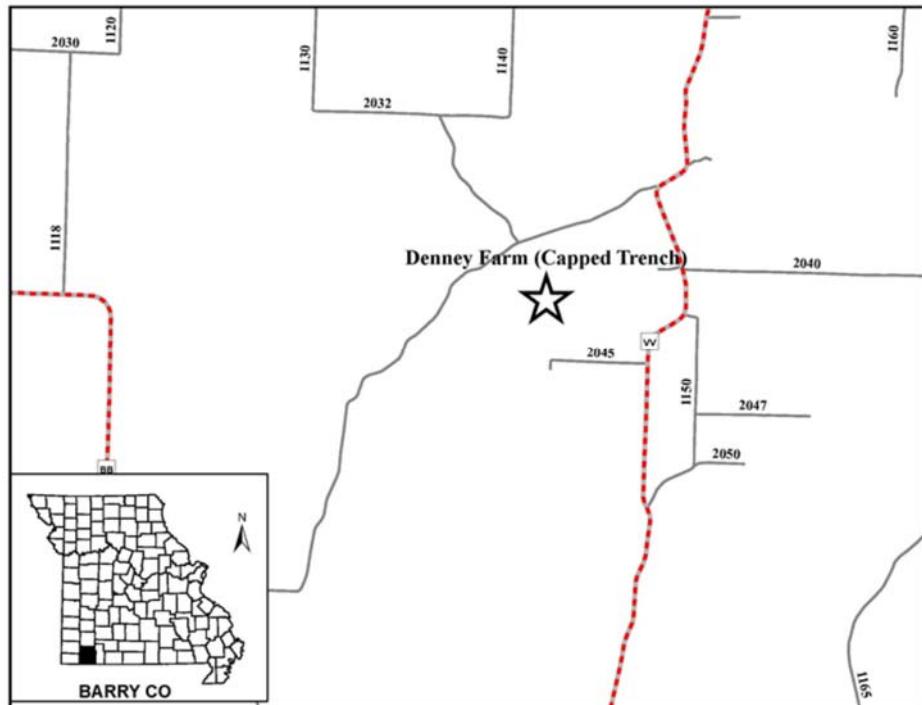
exposed to unacceptable concentrations of contaminants from the site. On-site monitoring well sampling continues to find detections of total chromium below EPA's Maximum Contaminant Level.

As part of the second Five-Year Review, a site risk assessment was carried out in light of the revised toxicity and screening values for hexavalent chromium developed by EPA. Site data collected during the period 2004 through 2008 were used for the risk assessment. The current residential screening level for chromium for domestic water is 100 parts per billion, while the current residential soil screening level, based on carcinogenic risk, is now 39 parts per million; significantly lower than the cleanup level of 180 parts per million identified in the Action Memorandum approved by EPA in 1992. A recommendation was made to collect more soil data to enable current assessment of the site soils. Consequently, the Department developed a sampling and analysis plan for the site soils. The draft was commented on and discussed with Missouri Department of Health and Senior Services. Additional soil sampling is scheduled for 2019.

Based upon available information, this site may pose a health risk due to the unknown status of on-site soils. Following planned soil sampling in 2019, exposure risk can be reevaluated. Long-term protectiveness of the remedial action will be verified through continued monitoring of site groundwater monitoring wells.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Denney Farm (Capped Trench)



Site Name: Denney Farm (Capped Trench)

Classification: Class 4

Date of Registry Placement: January 24, 1992

Site Address: Seven miles south of Verona, Barry County, West of Highway VV, Part of NW 1/4, Sec. 20, T25N, R26W, McDowell Quadrangle

Present Property Owners: James Denney

Lead Agency: Missouri Department of Natural Resources

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

Quantity: Not determined

Site Description:

In 1971, the property owner buried about 90 drums of contaminated wastes on site in a shallow trench. In 1981, EPA excavated and removed the drums and about 140 cubic yards of TCDD-contaminated soil. When excavated, the trench measured roughly 12 feet by 61 feet by 5 feet deep. EPA backfilled the trench with compacted clay and capped it. The total Registry area is 1.5 acres, including

the capped trench and the uncontaminated buffer. The site is located in a previously used cattle pasture that is vegetated and marked with permanent monuments. The trench is surrounded by a field and several acres of forest. To restrict access, a perimeter fence surrounds the site, and a locked chain crosses the access road.

Environmental Problems and Areas of Concern:

Surface erosion leading to cap deterioration is a long-term concern. Due to a lack of continual site maintenance over the years, clusters of trees, animal burrow holes, brambly/patchy vegetative growth, and the beginnings of surface soil erosion could potentially create environmental problems associated with the landfill cap's integrity.

Remedial Actions:

In 1980, after an anonymous tip, EPA conducted a site inspection and found partially buried leaking drums, drum fragments, and contaminated soil. In June 1981, drums of TCDD contaminated waste and TCDD soil were excavated and removed from the trench. EPA soil analyses indicated some TCDD-contaminated soil remained in the trench; however, due to excavation constraints, EPA decided to cease the excavation and cap the

trench. The TCDD-contaminated soil and drummed wastes were destroyed on site via thermal treatment.

The remaining TCDD-contaminated soil in the trench averaged about 10 parts per billion TCDD, with a maximum level of 530 parts per billion. The decision to backfill the trench was based on the following information provided by geologic and waste-isolation professionals:

- The sides and bottom of the trench were composed of a very dense and impermeable soil, which the Department substantiated by a permeability test;
- No joints or openings capable of transmitting water from the surface to underlying bedrock were noted; and
- The remaining TCDD was considered immobile and would not migrate unless transported by water percolating through the trench.

The trench was backfilled with compacted low-permeability clay, and an impermeable plastic cap was installed to prevent surface water percolation into the trench. Sod was then placed over the impermeable cap's topsoil to prevent erosion. Monuments at the trench's corners permanently mark the area. A permanent perimeter fence surrounds the site.

Based on local groundwater data, the site is approximately 140 feet above Calton Creek, which reflects the groundwater table level in the creek's valley. Thus, the site is well above the local groundwater and should not directly impact it. Groundwater monitoring consisted of collecting and analyzing water samples from local private wells during and after the remedial action. The private well sampling indicated no significant contamination loss from the trench had occurred.

The April 2018 annual site inspection report noted no warning signs were attached to the fence or gate. Based on the site's condition, the site's owner has not been able to maintain the site. Clusters of black locust trees, animal burrows, and vegetative cover of multiflora rose (brambles) potentially could create environmental problems associated with the landfill cap's integrity. None of the stone corner markers were located during the inspection.

General Geologic and Hydrologic Settings:

The topography around the site is

characterized by valleys and ridges. The major streams have broad, flat, deeply-incised valleys, and smaller tributaries dissect the plateau surface, resulting in rugged terrain. The site sits atop a wooded northwest-trending ridge that is truncated by the valley of Calton Creek. The site itself is nearly flat. Surface runoff drains to the northeast or southwest to small tributaries of Calton Creek. Although the section of Calton Creek nearest the site is gaining, the upstream and downstream reaches, as well as most of Calton Creek's tributaries, lose significant portions of their flow to the subsurface. Due to the highly permeable nature of the surface materials and bedrock, surface runoff around the site rarely occurs.

The subsurface geologic conditions for the site were obtained from site borings. The surficial materials consist of 0 to 6 feet of windblown silt (loess) throughout the site. Across portions of the site, a fragipan (densely packed layer of chert fragments and clay) may exist at a depth of about 3 feet. The fragipan typically acts as a barrier to downward migration of water, causing seasonal or temporary perched water conditions. The loess is underlain by 8 to 33 feet of red, hard, clayey silt ranging from pure clay to sandy clay with isolated chert fragments possibly derived from the weathered bedrock. The clayey silt grades into a weathered bedrock horizon of 2.7 to 5 feet of weathered white chert boulders with red clay seams. The bedrock below the weathered bedrock horizon consists of a jointed hard, dense white to light gray waxy chert. The jointed bedrock grades into the Reeds Spring Formation, a competent limestone that slopes east from bedrock high at the northwest corner of the site. The Reeds Spring Formation is neither weathered nor contains karstic development. The Reeds Spring Formation along with the underlying Pierson Formation represents the shallow aquifer in this area.

Remnants of a Pennsylvanian-age sandstone layer is also present near the site.

Due to limited yields, the shallow aquifer primarily serves individual households. Wells requiring high yields, such as community wells, must tap the deep aquifer, which is composed of Cambrian- and Ordovician-age carbonates and sandstones. The deeper aquifer is separated effectively from the shallow aquifer by a confining unit at a depth

of about 300 feet.

Public Drinking Water Advisory:

The closest public water well to this site is over 4 miles away and no site-related impacts are expected.

Health Assessment:

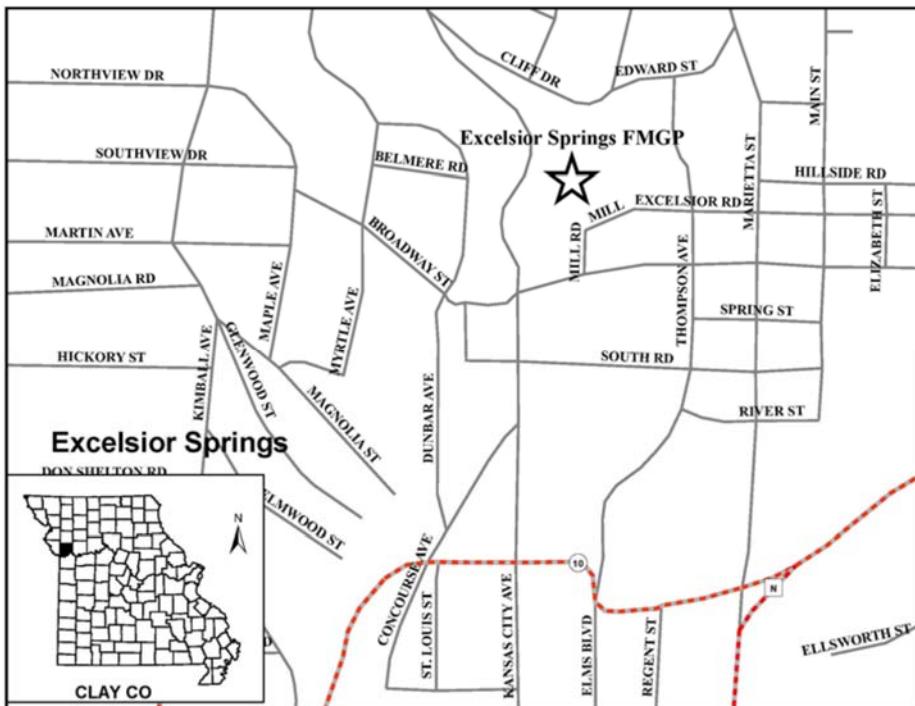
TCDD is the chemical of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

In June 2006, a well water sample was collected from a landowner whose property borders this site. The Missouri Department of Health and Senior Services was unable to find a lab that could test for TCDD; however, they were able to test for a component found with TCDD, called 2,4,6-trichlorophenols (TCP), which is more mobile in groundwater than TCDD. No TCP was detected in the sample submitted.

Based on the available information, this site does not appear to present a significant health risk to the public at this time. The site is in a remote area and has been capped. If use of this site were to change, or excavation or surface grading were to occur and expose contaminated soil, exposure to TCDD-contaminated soil could occur.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Excelsior Springs FMGP



Site Name: Excelsior Springs Former Manufactured Gas Plant

Classification: Class 4

Date of Registry Placement: May 6, 2003

Site Address: 320 W. Excelsior Street, Excelsior Springs, Clay County, Mo

Present Property Owner: Excelsior Springs Housing Authority

Lead Agency: Missouri Department of Natural Resources

Waste Type: Coal tar, which contains volatile organic compounds (VOCs) and semi-volatile organic compounds, including polycyclic aromatic hydrocarbons (PAHs)

Quantity: Not determined

Site Description:

The Excelsior Springs Former Manufactured Gas Plant occupies about one acre in a mixed business/residential area. Department personnel discovered the site after identifying former manufactured gas plant structures on historic Sanborn Fire Insurance maps dating between 1900 and 1913. The structures depicted include a 12,000-cubic-foot-capacity

gas holder, a 30,000-cubic-foot-capacity gas holder, purifiers, a retort room, and an oil tank. None of the aboveground former manufactured gas plant structures remain.

Currently, the Excelsior Springs Housing Authority operates the Ruey-Anne Apartment building for low-income persons/families at this location. Approximately 70 residents live in the building. Underground former manufactured gas plant structures are located under the apartment building and immediately north and west of the apartment building.

Environmental Problems and Areas of Concern:

PAHs were detected in sediment of the Dry Fork of Fishing River, but hazardous substances were not detected in the surface water. Groundwater contamination, including benzene, toluene, ethylbenzene, and xylene (collectively known as BTEX) compounds, PAHs, and one or more Resource Conservation and Recovery Act heavy metals remain on site. The owner placed institutional controls in the form of an environmental covenant on the property, which will minimize the present and future potential for exposure to contaminated groundwater.

Remedial Action:

In March 2000, the Department completed a Pre-Comprehensive Environmental Response, Compensation, and Liability Information System site screening investigation and in September 2000, a Preliminary Assessment/Removal Site Evaluation investigation. The investigations documented coal tar residuals in surface and subsurface soil and PAHs present in the sediment of the Dry Fork of Fishing River. The investigations concluded that the presence of hazardous substances poses a threat to human health and the environment and that a release to surface water is suspected due to the contaminated sediment. The Department recommended a removal action under Comprehensive Environmental Response, Compensation, and Liability Act authority, to further characterize and delineate surface soil contamination, including action to minimize or eliminate exposure to contaminated soil.

In April 2001, the Department began negotiations with AmerenUE (the responsible party) on an Administrative Order on Consent for a non-time-critical removal action. AmerenUE submitted a site evaluation work plan in March 2002 and performed the site evaluation in October 2002. Due to failure to negotiate a mutually-agreeable Administrative Order on Consent, this evaluation was conducted without any state or federal oversight or approval of the work plan.

Because the negotiations failed, the Department referred the site to EPA for enforcement action. Both EPA and the Department provided comments on all past data and work conducted without approval, along with a Risk Assessment for Residents and Employees Exposed to the Surface Soils at the Ruey-Anne Apartment building. AmerenUE completed site characterization activities, including sampling on-site monitoring wells, indoor-air sampling, and an off-site investigation in summer 2004. AmerenUE began removal action activities in 2005. A final Engineering Evaluation/Cost Analysis was approved by EPA in fall 2005. On January 18, 2006, EPA signed an Administrative Settlement Agreement and Order on Consent for removal action at the site.

In February 2006, AmerenUE completed removal action activities at the site. A total of

approximately 1,900 tons of soil and source material were excavated and removed from the site. Material was removed from the areas around the eastern gas holder, the western gas holder, and from a relatively small, isolated area north of the western gas holder. Clean backfill was placed in each excavation area. Because much of the eastern gas holder's footprint lies under a walkway extending from the Ruey-Anne Apartment building, impacted soil columns beneath each piling had to be left in place. In April and May 2006, surface restoration was conducted.

In spring 2006, AmerenUE prepared a post-removal action Human Health Risk Assessment. Due to contamination left in place after the removal action completed in 2006, the city of Excelsior Springs was required by city ordinance to enter into a memorandum of understanding with the Department. This was to ensure that appropriate institutional controls are in place to restrict the use of groundwater for a potable drinking water supply. On June 2, 2008, the Housing Authority of Excelsior Springs filed with the Clay County Recorder of Deeds both a memorandum of understanding and a restrictive covenant to address contaminated soil left in place after the removal action and to restrict the use of groundwater and soil excavation in specified areas at the site. EPA approved the Remedial Action Completion Report in February 2009. EPA sent a Notice of Completion to AmerenUE in March 2009. The Department completed the Fiscal Year 2018 annual inspection on May 17, 2018. The inspection report noted nothing of significance.

General Geologic and Hydrologic Setting:

The site is located within the Dissected Till Plain section of the Central Lowlands physiographic province. Topography in this region consists of moderately dissected plains. The region consists of Quaternary alluvium and glacial material deposited over Pennsylvanian-age sedimentary rock.

Unconsolidated deposits at this site consist of 3 to 6 feet of fill over silty to sandy clay, interbedded with clay and gravelly clay alluvium developed from the Dry Fork of the Fishing River. The uppermost bedrock, the Pennsylvanian-age Pleasanton Group, is composed of interbedded shale and limestone. This bedrock unit ranges from 6 to

36 feet, slopes to the northwest, and has an average thickness of approximately 60 feet.

An unconfined water-bearing zone is present within the unconsolidated overburden materials, with flow to the southwest. The depth to groundwater ranges from 5 to 8 feet below ground surface. The uppermost bedrock aquifer is hosted in sandstones of the Pleasanton Group. Municipal drinking water for the city of Excelsior Springs is obtained from public water-supply wells from the Pennsylvanian-aged sediments of the Pleasanton, Marmaton, and Cherokee groups, and Ordovician-aged sandstone of the St. Peter Sandstone.

Public Drinking Water Advisory:

The City of Excelsior Springs obtains water from an alluvial well field about 6 miles south of this site. No additional public water sources occur in this area and no site-related impacts are expected.

Health Assessment:

The major contaminants of concern found in soil, sediment, or shallow groundwater at the site are: benzene, naphthalene, toluene, xylene, arsenic, mercury, selenium, silver, cyanide, cadmium, chromium, barium, and an additional 16 chemicals collectively grouped into the polycyclic aromatic hydrocarbons (PAHs). Among the PAHs found on site are the following potential human carcinogens: benz(a)anthracene, benzo(b)fluoranthene, benzo(l)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-c,d)pyrene. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential health effects associated with these contaminants.

In 2000, the Missouri Department of Health and Senior Services conducted a health investigation to determine the potential health risks associated with the site. The potential on-site and off-site exposure pathways are dermal contact, incidental ingestion, and inhalation of metals, PAHs, and VOCs found in soil.

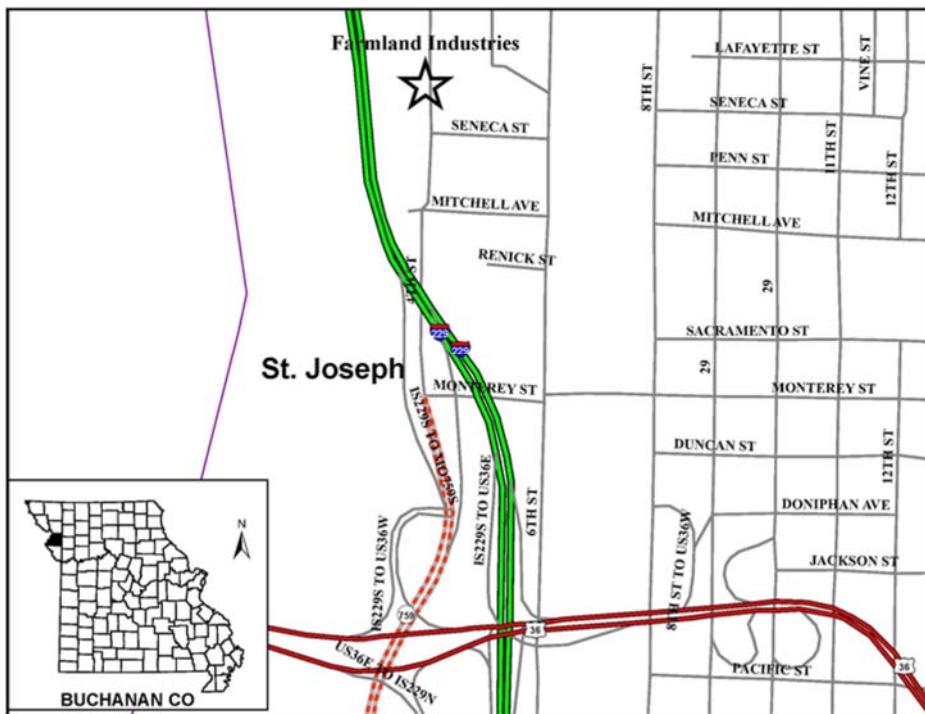
Between 2000 and 2005, AmerenUE conducted a site investigation to determine the potential risk of exposure to on-site and off-site groundwater, as well as to surface water and sediment in the Dry Fork of the Fishing

River. The investigation found a potential risk to human health associated with exposure to soil, which prompted soil removal activities at the site. After the remediation, the health risk associated with exposure to contaminants in soil for residents and workers is within EPA's acceptable cancer and non-cancer risk ranges, according to Missouri Department of Health and Senior Services Human Health Risk Assessment dated May 2006. This includes human health risk associated with contaminant vapors migrating from soil into the Ruey-Anne Apartments. Human health risk for domestic use of shallow groundwater was not estimated for on-site future residents, workers, or for adjoining properties. Only health risk associated with incidental contact with groundwater during future construction was estimated to be within EPA's acceptable risk range. Human consumption of groundwater is being prohibited on the property through groundwater-use restrictions placed in the property chain of title.

Based on available information, health risk associated with exposure to soils, sediment, and surface water is within EPA's acceptable limits. On-site and off-site groundwater-use restrictions will minimize potential risk associated with contaminants in the groundwater.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, (573) 751-6102.

Farmland Industries



Site Name: Farmland Industries Old Insecticide Plant

Classification: Class 4

Date of Registry Placement: March 30, 1988

Site Address: 4th and Seneca Streets, St. Joseph, Buchanan County, Missouri NW 1/4, Sec. 17, T.57N, R.35W, St. Joseph North Quadrangle

Present Property Owner: Burlington-Northern Santa Fe Railway Company (BNSF)

Lead Agency: U.S. Environmental Protection Agency (EPA)

Waste Type: Pesticides, polycyclic aromatic hydrocarbons (PAHs), heavy metals, and volatile organic compounds (VOCs)

Quantity: Not determined

Site Description: The Farmland Industries Old Insecticide Plant site is the location of a former pesticide formulation plant. This site is approximately 2.6 acres in size and is located on the eastern bank of the Missouri River in a moderately industrialized area of the flood plain. Numerous manufacturing and warehouse facilities are located adjacent to

the site.

This subject site is owned by BNSF, and the land was leased to several different companies throughout history. Prior to 1950 and the lease of the site for pesticide formulation, the property was used by BNSF and Union Pacific Railroad Company. Several companies occupied the site while formulating organochlorine pesticides between 1950 and 1980. Farmland Industries was the last pesticide manufacturer to own this property from 1974 until the plant was closed in 1980.

Significant pesticide contamination was documented in soil and groundwater at the site after plant closure. Buildings and associated facilities were removed in late 1979 and early 1980. In 1989, the site was clay capped and vegetated. A six-foot high, chain-link security fence encompasses the entire site, and warning signs are posted.

In 1988, the Farmland site was placed on the Registry as a Class 2 site. The Farmland site was downgraded to a Class 3 site in 2011.

Environmental Problems and Areas of Concern:

Soil samples collected in early 1980 detected

significant concentrations of pesticides and heavy metals. In 1985, EPA collected surface soil samples that showed elevated concentrations of chlordane, heptachlor, aldrin, and dieldrin with some results in the parts per thousand range. Samples from one area contained greater than one percent chlordane. In addition to contaminated surface soils, subsurface soils and groundwater were contaminated.

Years after the site was capped, the Missouri Department of Health and Senior Services expressed concerns that the area outside the capped and fenced area was possibly contaminated with high levels of pesticides and that the extent of the contamination was not defined around the site.

The Missouri Department of Natural Resources conducted a Site Reassessment for Farmland Industries Old Insecticide Plant in August 2007 to address the Missouri Department of Health and Senior Services' concerns. In October 2008, as part of the Site Reassessment, the Department collected subsurface soil, surface soil, and groundwater samples from the perimeter of the capped and fenced Farmland site as well as the adjacent properties.

The Site Reassessment sampling documented pesticide contamination on nearly all properties immediately surrounding the Farmland site at concentrations significantly above background and above EPA industrial screening levels, however they did not exceed EPA industrial regional removal management or cleanup levels. However based on these exceedances, Missouri Department of Health and Senior Services was requested to evaluate the Site Reassessment sampling results (for more details see the Health Assessment section below).

Remedial Actions:

On November 2, 1989, EPA entered into an Administrative Order on Consent with Farmland Industries Inc., Missouri Pacific Railroad Company, and BNSF to implement the proposed capping plan and to reimburse EPA for oversight costs.

A Capping Plan was implemented in November and December 1989. All quadrants of the site that contained a total pesticide

concentration of 50 parts per million or greater were capped with 18 inches of clean clay soil. Contaminated areas immediately outside the existing fence that exceeded the capping standard were removed for placement under the cap. The facility fencing was maintained as the primary means of access control. Above-grade structures that hindered placement of the cap were removed. The site was prepared and seeded in April 1990. A good vegetative cover is established on the clay cap.

The liquidating trustee, BNSF, and the Department reached a settlement agreement following the bankruptcy of Farmland Industries, Inc. BNSF has taken over site maintenance and reporting obligations pursuant to the settlement agreement including Operational and Maintenance Reports. These reports summarize all activities performed for the operation and maintenance of the cap during the preceding 12 months.

In 2016, BNSF inquired with the Department and EPA about decreasing its monthly site cap monitoring requirement to quarterly monitoring or possibly annual monitoring. BNSF also requested a new agreement for coordination of the oversight with just BNSF and the Department versus BNSF and EPA. The Department is proceeding with writing an Environmental Covenant for the Farmland site. Once the Environmental Covenant is executed, the Administrative Order on Consent will need to be terminated and a Post -Closure Site Management Plan will need to be written to address future Operational and Maintenance of the site. Upon implementing the Environmental Covenant, the Farmland site will be recommended for removal from the Registry. Long-term stewardship mechanisms would be employed to ensure that the existing land use of the site not be changed to allow for greater human contact to site contaminants (such as allowing residential use) without further assessment and possibly remedial actions.

On May 16, 2018, the Department completed the Fiscal Year 2018 annual Registry inspection and noted that the site is an open, well-mowed grass field in excellent condition.

General Geologic and Hydrologic Setting:

Overburden at this location is composed of fill

material over thick alluvial deposits, which are estimated to be 60 to 100 feet thick. The alluvium is composed of sand, silt and clay; with the coarser-grained material predominant at depth. Clay-rich material is present beneath the eastern portion of the site.

The uppermost aquifer at this location is the Missouri River alluvium. Depth to groundwater, as indicated by monitoring wells, is 10 to 25 feet. Off-site migration of contaminants in groundwater most likely is toward the Missouri River; however, the potential does exist for high-yield wells to alter flow direction in the alluvial aquifer.

Because the bedrock here typically displays low permeability, contaminants are not anticipated to affect groundwater in the bedrock.

Public Drinking Water Advisory:

The city of St. Joseph obtains groundwater from a well field in the Missouri River alluvium located several miles upstream from this site, and no other public water sources exist in this area. No impacts are expected.

Health Assessment:

The following are the major contaminants of concern: aldrin, chlordane, dichlorodiphenyltrichloroethane (DDT)/ dichlorodiphenyldichloroethane (DDD) / dichlorodiphenyldichloroethylene (DDE), dieldrin, endrin, hexachlorobenzene, heptachlor, PAHs, and beryllium. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

The Farmland site is located in the Missouri River alluvium and is within two hundred feet of the river. Because of the site's proximity to the Missouri River and the documented pesticide contamination of soils and groundwater outside of the fenced and capped area, it is possible that the Missouri River is also being affected. The chlorinated insecticides at this site are fat soluble and are known to accumulate in the food chain. If pesticides from the Farmland site are bioaccumulating in fish tissue, then human exposure is possible through the consumption of contaminated fish. Missouri Department of Health and Senior Services monitors for

pesticides in fish throughout the Missouri River, but no recent testing has occurred in relation to this site.

Missouri Department of Health and Senior Services completed a Health Consultation in 2011 and found all chemicals present in the surface soils surrounding this industrial site to be below levels of health concern for non-cancer health effects. Based on the maximum levels that were detected in the Department's samples in surface soils, several PAHs and pesticides were above the EPA cancer risk screening level for industrial soils. However, the maximum levels of pesticides are primarily based on one sample while the elevated PAH levels appear to be prevalent throughout this industrial area. Contaminant levels in other adjacent properties were generally not above screening levels. Missouri Department of Health and Senior Services concluded that the amount of exposure to chemicals in the area surrounding the Farmland site is not expected to harm people's health as long as the clay cap, grass cover, and site fencing is maintained. Outside the site, maintenance of a grass cover and basic precautions such as use of personal protective equipment if digging in the soils around the site, would limit direct contact with soil. The nearest residences are approximately 0.5 miles away.

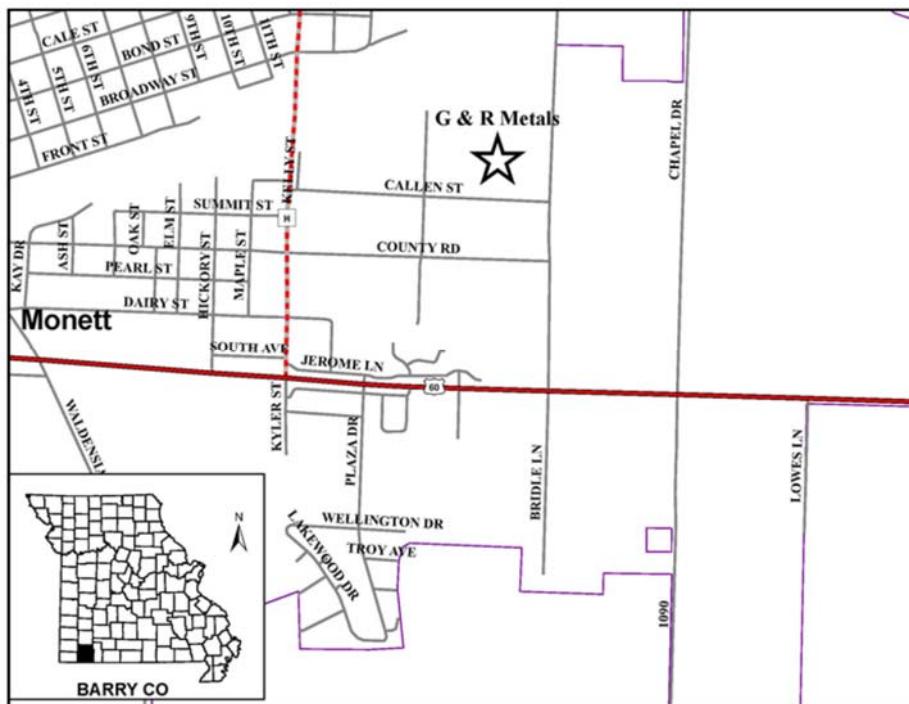
Missouri Department of Health and Senior Services also recommended in the Health Consultation, if any expansion is made to the building just south of the Farmland Industries site property or if this building is torn down, a reassessment of the site needs to be completed, including soil, water, and air sampling, because additional exposure could take place. Long-term stewardship mechanisms should be employed to ensure that the existing land use of the site not be changed to allow for greater human contact to site contaminants (such as allowing residential use) without further assessment and possibly remedial actions.

On-site contamination does not appear to pose a significant health risk to the public at this time as long as the cap and vegetation is maintained and fenced and personal protective equipment is used in the event that soils are disturbed. Based on the possible effects on the Missouri River, this site poses a potential off-site risk.

For more information regarding health-related

issues, please contact the Missouri
Department of Health and Senior Services,
P.O. Box 570, Jefferson City, MO 65102,
573-751-6102.

G & R Metals



Site Name: G & R Metals

Classification: Class 4

Date of Registry Placement: August 17, 1989

Site Address: Monett Industrial Park, one-half block east of the intersection of Callan and Industrial Streets on the north side of Callan Road. Portions of the NW 1/4, SE 1/4, Sec. 32, T. 26N, R. 27W, Barry County, Missouri, Monett Quadrangle

Present Property Owner: Wintech Properties, LLC

Lead Agency: Missouri Department of Natural Resources

Waste Type: Cadmium, chromium, and cyanide

Quantity: Not determined

Site Description:

From 1969 to 1976, the G & R Metals Company operated a metal finishing and plating business on this site. G & R used a 6-to 8-acre lagoon on the property as an impoundment for cyanide- and cadmium-

contaminated waste waters discharged from its production processes. The lagoon was constructed without a permit or geologic evaluation and reportedly had a leakage problem. In fall 1976, G & R ceased doing business. The sides of the lagoon were subsequently pushed in and the area leveled.

The land surrounding this site is primarily an industrial park. Many small industries exist in the area, consisting primarily of light manufacturing. The site was later used as a shooting range.

Environmental Problems and Areas of Concern:

The site's most significant environmental problems are potential off-site transport of contaminated soil by surface erosion and potential leaching of contaminants into the local shallow groundwater supply.

Remedial Actions:

In 1976, G&R Metals closed and backfilled the lagoon. Monett Industrial Development Corporation (MIDC) subsequently acquired the property, applied to the Department's Brownfields/Voluntary Cleanup Program, and was accepted in January 1997. Later that year, MIDC had a monitoring well drilled to

sample the uppermost aquifer below the site for metals contamination prior to approval of a proposed cap over the site. No contaminants were detected in the well above drinking water standards; however, cyanide was detected above background levels at a depth of 40 feet. In February 2000, MIDC had the monitoring well sampled again. Results indicated a dissolved lead concentration in the groundwater above drinking water standards. The Department requested further sampling to investigate lead levels in the groundwater. Additional groundwater samples have had no further contamination detected above standards. The Department determined the former lagoon was not a source of significant groundwater contamination.

MIDC's remedial action plan for soil/sediment on the ground surface, prepared and approved in 1999, proposed the installation of an impermeable clay liner and cap. MIDC's consultant conducted surface sampling to determine the required area for the cap. The plan also allowed for the scraping and consolidation of the soil/sediment into a smaller area prior to capping, once the contaminated area had been delineated fully.

The sampling and consolidation was completed, and verification sampling showed that the scraped areas were below applicable commercial and industrial target levels for chromium, cyanide, and cadmium. By July 2000, after surveying the consolidation area, an engineered cap made of compacted clay was placed over the contaminated soil. The cap will prevent direct human and environmental exposure to the contaminated soil and prevent infiltration of rainwater so that the contamination will not affect the groundwater in the future.

The site's closure was completed in 2001 under the Brownfields/Voluntary Cleanup Program. A survey delineated the capped area and barriers were installed. MIDC filed a restrictive covenant in the property chain of title to prevent cap disturbance, provide for inspection and maintenance, and limit property use to industrial and other specified uses. The Registry area was reduced from the property boundaries to cover only the portion of the site containing the capped soil, plus a buffer zone, and the area was designated with permanent markers.

Following the closure, the adjacent property

owner, Window Technology Corporation (Wintech), expressed interest in the property for equipment storage and vehicle parking. In 2002, the Department approved a Registry change of use request to allow use of the capped area for an industrial parking lot and storage area. Wintech had the cap covered with a compacted gravel driving surface. In 2016, Wintech expanded its facility and proposed a plan to again reconfigure the capped area's surface to replace employee parking lost in its building expansion. The plan called for additional fill to be placed over the capped area, followed by asphalt pavement, and redirection of storm water drainage. The Department approved the plan, and construction was completed in summer 2016. Markers at the cap edges were replaced and are maintained so that the waste will not be disturbed. The Fiscal Year 2018 Registry annual inspection was completed by the Department on May 10, 2018. No problems were noted in the inspection report.

General Geologic and Hydrologic Setting:

The site's land surface gently slopes to the north-northwest toward Kelly Creek, which is about 200 feet from the site and 35 to 40 feet lower in elevation. Kelly Creek carries water only after heavy rains, generally losing all of its flow to the subsurface.

Bedrock is composed of highly-weathered, cherty limestone. The overlying residuum formed from this weathering is a very cherty, red clay that has a moderate to high permeability. The residuum is 50 to 70 feet thick. Solution-enlarged fractures and bedding planes within the bedrock allow for rapid recharge of the shallow aquifer.

The shallow aquifer, which provides a source of water for domestic wells in the area, is made up of cherty limestone. The shallow aquifer is separated from the deeper aquifer by a confining layer, which is more than 300 feet deep. The city of Monett draws its water supply from the deeper aquifer. Groundwater flow in both aquifers is expected to be toward the west.

Public Drinking Water Advisory:

There are six active public water wells within 1 mile of this site, all of which draw water from the deep Ozark aquifer. Although shallow aquifer contamination is recognized, no site-

related impacts are expected.

Health Assessment:

Contaminants of concern at this site include cadmium, chromium, and cyanide. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential health effects associated with these contaminants.

A door-to-door survey failed to locate any private water wells around the site. A monitoring well placed downgradient of the lagoon in 1997 showed a lead level of 31 parts per billion. This is twice the EPA Maximum Contaminant Level, the legal threshold limit on the amount of substance that is allowed in public drinking water systems. However, subsequent sampling found no further contamination above health standards, and quarterly monitoring was discontinued.

Based on available information, this site does not appear to pose a significant health risk at this time as long as the cap remains intact. If site conditions were to change such that exposure to contaminated soils were to occur, adverse health effects could occur.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Jones Truck Lines



Site Name: Jones Truck Lines

Classification: Class 4

Date of Registry Placement: January 1, 1984

Site Address: 5601 Hall St., St. Louis, Mo

Present Property Owner: Sibic Realty LLC

Lead Agency: Missouri Department of Natural Resources

Waste Type: 2,3,7,8-Tetrachlorodibenzodioxin (TCDD)

Quantity: Not determined

Site Description:

The site is a 6-acre parcel located in a commercial/industrial area along the Mississippi River north of the St. Louis city center. Various unidentified parties disposed of fill material on the property over several decades, possibly including municipal waste. Following grading and development of the parcel, Jones Truck Lines Inc. operated a truck terminal at the site beginning sometime after 1965. In 1970 or 1971, Jones hired an independent contractor to spray the gravel truck parking area for dust suppression. The

contractor sprayed oil on the lot that had been mixed with chemical manufacturing waste containing TCDD. During this time period, the same contractor conducted similar dust suppression spraying at other locations in eastern Missouri, contaminating a number of properties in the process. Jones Truck Lines Inc. was acquired by Sun Carriers Inc. in 1980. Sun Carriers Inc. subsequently moved trucking operation off site. The parcel currently is being used as a trucking transportation hub by another lessee.

In 1983, EPA conducted sampling at the Jones Trucking site as part of a regional assessment of areas potentially contaminated by TCDD. EPA detected levels of TCDD in soil above the health-based benchmark of one part per billion. TCDD concentrations exceeded 20 parts per billion in some areas of the site, mandating a cleanup action. The property has a brick building along the south end, a connected and roofed truck parking bay, and a smaller, separate building in the northwest corner. Except for building footprints, the entire property is paved and fenced, and the entrance is gated.

Environmental Problems and Areas of Concern:

TCDD remains in subsurface soils at the site beneath an asphalt cap at concentrations

above health-based cleanup levels. Deterioration or disturbance of the asphalt cap could result in direct exposure to dioxin-contaminated material.

Remedial Actions:

In the early 1980s, EPA collected samples from a sampling grid established across the parcel. Concentrations of TCDD above 20 parts per billion were documented in surface and shallow subsurface soil/gravel/fill material in several of the grid cells located primarily on the parcel's southern half. Many other parcels were found to contain dioxin concentrations between 1 and 20 parts per billion.

The Jones Truck Lines site is one of 27 eastern Missouri dioxin sites that are subject to a Consent Decree entered in Federal District Court on December 31, 1990. In accordance with the decree, EPA constructed a thermal treatment unit at Times Beach, Missouri, to treat the TCDD-contaminated materials excavated from these sites. EPA completed an Engineering Evaluation/Cost Analysis on July 21, 1995. The purpose of the analysis was to select the remedy and cleanup criteria for 27 eastern Missouri TCDD-contaminated sites. The cleanup criterion established in the Engineering Evaluation/Cost Analysis for industrial and commercial properties, such as Jones Truck Lines, was 20 parts per billion.

Since TCDD concentrations documented at Jones Truck Lines exceeded 20 parts per billion, EPA conducted a cleanup action. In 1995, EPA oversaw the excavation of 3,635 tons of soil from sampling grid cells where TCDD exceeded 20 parts per billion. The soil was transported to Times Beach for incineration. Clean fill material was imported to the site, and the entire surface was capped with a 6-inch layer of asphalt.

In November 1999, Hall Street Properties I purchased the property from Triad Carriers. A 2012 Registry site inspection noted there were areas throughout the parking lot that had cracks in the pavement. These cracks were addressed on May 1, 2013, by Pioneer Paving as part of maintaining the cap. On May 29, 2013, Department staff visited the site and observed the areas that had been patched/repaired. In July 2015, the property was sold to Sibic Realty LLC. A Phase I Environmental Site Assessment was conducted and noted

damage to the pavement around the truck scale in the site's northwest area and along the fence on the northwest perimeter. On June 25, 2015, Pioneer Paving and Sealing Company addressed these two areas. On July 14, 2015, Department staff inspected and verified the property had been repaved and properly sealed. No environmental concerns were noted during the May 31, 2018, annual site inspection conducted by the Department.

General Geologic and Hydrologic Setting:

The site is located on the western edge of the Mississippi River flood plain. Much development has occurred in this area, with many alterations to the natural setting. The thickness of the fill material is unknown; however, due to the age of the site, the majority of ground surface settling has probably already occurred. The asphalt cover restricts surface water infiltration.

The alluvial material beneath the site is composed of clay- to sand-sized particles. The alluvium is expected to be less than 45 feet thick. The direction of groundwater movement is toward the river, where it is eventually discharged. Due to the industrialized nature of the area, some contamination of the alluvial waters is probable, but a specific source would be very difficult to identify. It may take several years for any contaminants present in the shallow groundwater system to discharge to the river. Bedrock under the site is Mississippian-age limestone. At this location, the Mississippian limestones are not favorable for the development of drinking water wells, since high total dissolved solids render the water unusable for most purposes.

Public Drinking Water Advisory:

The City of St. Louis draws water from the Missouri and Mississippi rivers from locations upstream of this site, while Illinois American Water – East St. Louis draws from the Mississippi River approximately four river-miles downstream. No impacts are expected.

Health Assessment:

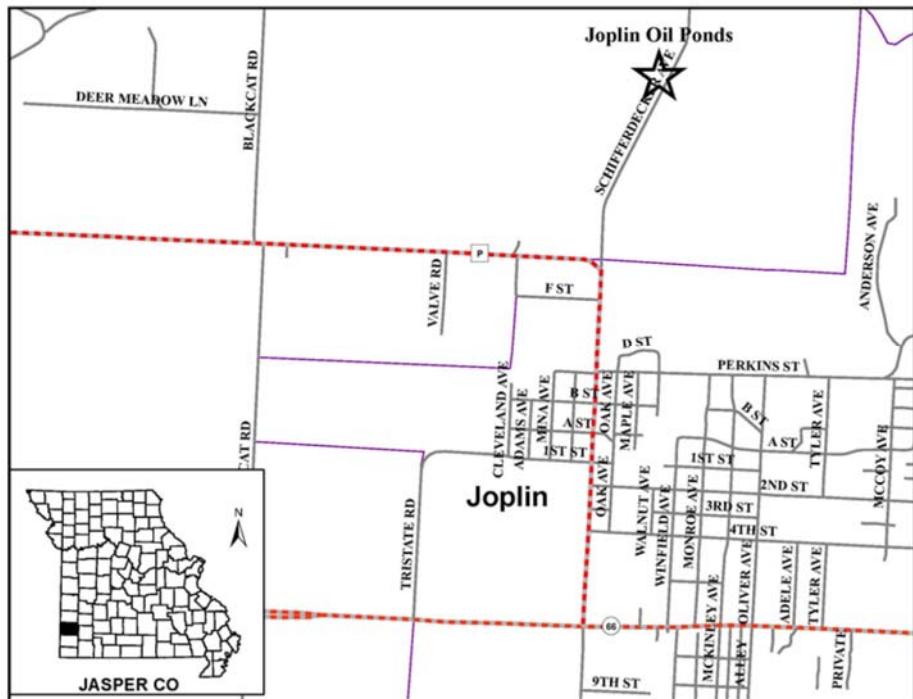
TCDD is the chemical of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

The TCDD-contaminated material beneath the asphalt cap poses no direct exposure concern at the site, and migration through surface water runoff or groundwater infiltration is unlikely as long as the cap remains intact. Should the cap deteriorate or be disturbed, potential exposure routes of concern would include ingestion of contaminated soil, inhalation of contaminated dust particles, and dermal contact with contaminated soil or dust. Cap removal or deterioration could result in erosion and migration of the contaminated material off site through surface water runoff.

Based on available information, this site does not appear to pose a significant health risk to the public at this time. However, if site conditions were to change such that exposure to contaminated soil were to occur, adverse health effects could result.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Joplin Oil Ponds



Site Name: Joplin Oil Ponds

Classification: Class 4

Date of Registry Placement: June 14, 1984

Site Address: Joplin, Jasper County, Missouri, SW 1/4, NW 1/4, Sec. 33, T. 28N, R. 33W, Joplin West Quadrangle

Present Property Owner: City of Joplin

Lead Agency: Missouri Department of Natural Resources

Waste Type: Lead

Quantity: Unknown quantity of residual lead contamination remains on site.

Site Description:

The site consists of two former city lagoons where septic tank haulers dumped wastes containing barium, chromium, lead, dichloroethane, trichloroethane, p-chloro-m-cresol, pentachlorophenol, and semi-volatile organic compounds. The 30-year old lagoons once were filled with sludge and water but have been almost completely cleaned out.

Environmental Problems and Areas of Concern:

Residual lead contamination remains in surface soil. The greatest potential for groundwater contamination exists in the mined out areas and solution cavities of the shallow bedrock aquifer.

Remedial Actions:

In November 1988, the Department approved a remedial action plan for the city of Joplin to treat the pond water and discharge it to the city's wastewater treatment plant. The sludge, which was stabilized with fly ash and mixed to partly dry it, was taken to the Peoria Disposal Services Inc. facility in Peoria, Illinois.

Removal of contaminated soil from the lagoons' bottoms and sides continued into February 1989. Several rounds of sampling determined lead was the only parameter still exceeding the 1990 Missouri Department of Health and Senior Services' residential applicable standards of 238 parts per million and the Cleanup Action Levels for Missouri (CALM) industrial soil target concentration of 660 parts per million in the surface soil. The city performed several additional removals of material from the ponds in 1989 and 1990; yet, in places, the lead level still exceeded residential standards at 780, 850, and 870

parts per million from composite sampling of two bank areas in the lower pond and from one composite sample of the upper pond bottom. These areas were sampled in 1990 and have not been resampled since that date. The current EPA regional screening lead action limit for industrial soil is 800 parts per million. Sampling of residual water in the ponds and public drinking water in the vicinity showed that the site is not causing water pollution problems. It is extremely unlikely the property will be used for residential purposes because it is owned by the city of Joplin and is surrounded by industrial uses and mine tailing wastes from the Oronogo-Duenweg mining belt. The surrounding lead levels were found to be higher than the any-use residential standard.

On April 26, 2018, the Department completed the Fiscal Year 2018 Registry annual inspection. All of the 2011 Joplin tornado debris placed on the property has been removed..

General Geologic and Hydrologic Setting:

Residual soils that have developed from Mississippian-age limestone are present at the site. The residuum contains a high percentage of stone in a clay matrix. Permeability of the material is high. Residuum thickness in the vicinity of the lagoons is estimated to be 10 feet; however, the area has been reworked, and some of the soil may have been removed.

Below the soil is a cherty, Mississippian-age limestone, which extends 80 to 120 feet below the surface. This limestone has undergone extensive weathering, producing subsurface cavities that provide avenues for water movement. Mining ores are present at a depth of about 80 feet. Room and pillar mining methods have been used to remove the ore. Consequently, numerous mine shafts occur on and around the property, and extensively-mined areas occur beneath the site. Large voids created by the mining activities are now filled with water, and large chat piles were present along the eastern and southern property lines. Potential for catastrophic collapse exists at the site, due to both the nature of the underlying bedrock and subsidence from the mining activity.

Two aquifers exist in the area: a shallow aquifer consisting of Mississippian-age

limestone at the zone of mineralization and a deep aquifer consisting of Cambro-Ordovician sandstone, dolomite and chert, located well below the ore-bearing strata. Surface and shallow groundwater movement in the area of the lagoons is generally to the east toward Leadville Hollow, and to the north toward Turkey Creek, a gaining stream. Due to the permeable nature of the soil and bedrock material, shallow groundwater is anticipated to be adversely affected by the site.

Public Drinking Water Advisory:

Missouri American Water – Joplin and Jasper Co. PWSD #2 use deep wells to draw water from the Ozark aquifer. The closest well to this site belongs to Jasper Co. PWSD #2 and is approximately 1.2 miles north of the site, while Missouri American Water – Joplin has three wells that are located approximately 2-3 miles south, southwest, and southeast of the site. General groundwater flow direction is to the north and east, but karst conditions and mine-related shafts and cavities provide an unpredictable pathway for rapid, shallow groundwater movement. Aquifer drawdown related to groundwater withdrawals occurs locally within the region and creates additional uncertainty with regard to mobility of potential contaminants. Migration of contaminants from the site does not appear to be a significant threat to local public water sources, but any observed increase or detection of contaminants in water produced by these wells warrants additional scrutiny.

Health Assessment:

The chemical of concern at this site is lead. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

Contaminated water and much of the sludge and soil were removed during a 1988 cleanup. Several samples taken after this cleanup found levels of lead in the lagoon bottom and sides above DHSS' recommended residential level of 238 parts per million. The city has put up an orange barrier fence to deter illegal dumping where the oil ponds are located.

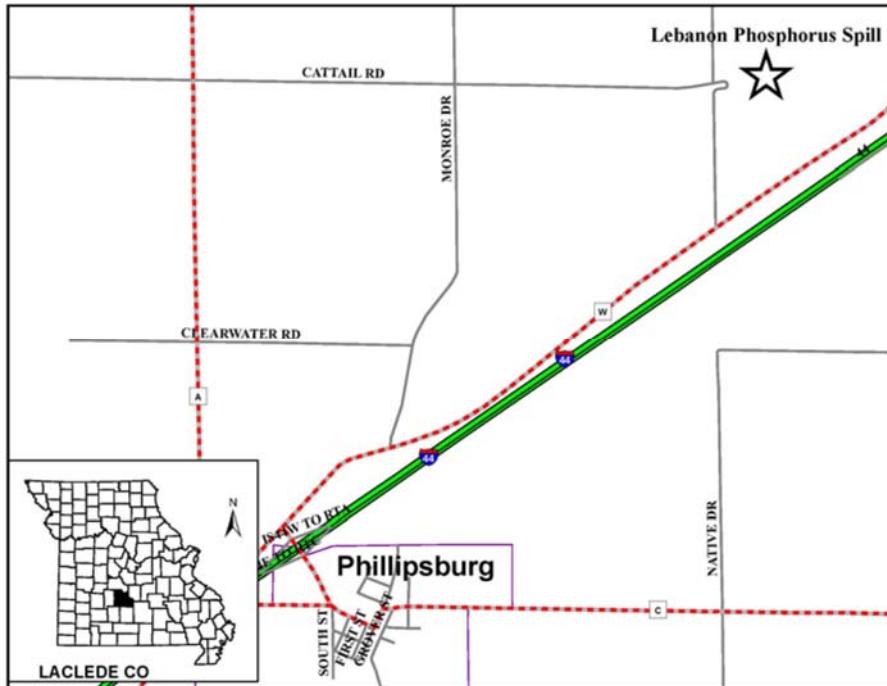
Routes of exposure include ingestion, direct contact, and inhalation. Present or future use of the property could result in exposure via dermal contact, inhalation, or ingestion of

contaminated soils.

Based upon available information, this site remains a low potential public health threat.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102.

Lebanon Phosphorus Spill



Site Name: Lebanon Phosphorus Spill

Classification: Class 4

Date of Registry Placement: July 1, 1985

Site Address: Two miles northeast of I-44 and W Highway, east on gravel road alongside tracks for 200 feet past Huben railroad marker, Laclede County, SE 1/4, SW 1/4, SW 1/4, Sec. 12, T. 33N, R. 17W, Phillipsburg Quadrangle

Present Property Owner: Burlington Northern Railroad/San Francisco Railway Company

Lead Agency: Missouri Department of Natural Resources

Waste Type: Red and yellow phosphorus

Quantity: 5,000 gallons in buried railcar

Site Description:

The Lebanon Phosphorus Spill Site resulted from the August 13, 1972, derailment of a Frisco freight train, now Burlington Northern Santa Fe (BNSF), about 2 miles northeast of the town of Phillipsburg. The wreck caused spillage of portions of two tank cars of "red

and yellow" phosphorus, another car described variously as soda ash or 12-12-12 fertilizer, one car of "mineral wool," and one car of wooden ties. The wreck resulted in a fire, fueled by the phosphorus, which ignites on contact with air. One of the 10,000-gallon phosphorus cars was completely burned, while the other car was only half burned, leaving about 5,000 gallons of liquid; the percentage of phosphorus unknown.

BNSF buried both of the tank cars on site. The site is located in an upland setting just north of the railroad tracks and east of the county road. No residences are in the immediate vicinity, and land use is agricultural.

Environmental Problems and Areas of Concern:

Fish kills occurred at two lakes downstream from the spill site in late November 1972. The current cap remains in good condition.

Remedial Actions:

In August 1972, BNSF buried the two wrecked tank cars on the property adjoining the railroad property in order to extinguish the phosphorus fire, which combusts on contact with air. BNSF capped the burial site with an asphalt pad. A stone marker, warning not to

drill or dig, was placed on top of the pad. Over the years, the asphalt cap began to deteriorate and crumble. In October 1988, BNSF installed a new 4-inch thick concrete cover at the site. The cover measures about 60 by 90 feet and is graded slightly to prevent ponding of water. It consists of a sand layer covered by 5-ounce polypropylene, then covered by an 18-mil mirafi-coated fabric. Because the fabric cover had been damaged and cut open by someone driving on it, sections of steel pipe were placed around the pad's perimeter to prevent vehicles from driving on it again.

The Missouri Department of Natural Resources and the Missouri Department of Health and Senior Services conducted well sampling in 1994, 1996, and 1999, and found no evidence of contamination above the drinking water standards in any of the tested wells.

To determine if contaminant migration had occurred, BNSF collected subsurface soil samples advanced to a depth of 20 feet below ground surface adjacent to the buried railcars in 2000 (six borings) and 2007 (eight borings). Phosphorus sample results ranged from 67.8 to 6,260 parts per million and from less than 11.5 to 583 parts per million, respectively. Background concentrations of phosphorus, range from 400-1,000 parts per million, according to information obtained from Missouri State University. At the time of the soil investigation, groundwater was not encountered. The concrete cap was repaired and resealed as a preventive measure to ensure its continued effectiveness. New fencing, of sufficient height to discourage vandals, was established around the cap's perimeter.

In September 2013, BNSF conducted site groundwater monitoring activities. Due to the absence of groundwater in both monitoring wells, only two of the four proposed monitoring wells were installed, MW-01 and MW-02. No water was observed in these two wells. The total depths for MW-01 and MW-02 were 29.10 feet below ground surface and 25.47 feet below ground surface, respectively.

On September 25, 2013, as part of routine track maintenance, a BNSF maintenance-of-way crew excavated soil beneath a mainline track, which is adjacent to the Lebanon Phosphorus site. The excavated soil was

stockpiled approximately 50 feet northwest of the concrete pad. The maintenance-of-way crew observed intermittent small wisps of smoke coming from the stockpiled soil.

On September 26, 2013, Compliance One, the environmental contractor responsible for the concrete pad's annual sealing, observed smoke coming from a single location in the soil stockpile and reported this to the BNSF Environmental Remediation Manager. The stockpiled soil was located near trees; therefore, BNSF requested that Compliance One move a portion of the soil to an area on-site that was not near vegetation. The contractor also reported seeing small, intermittent wisps of smoke while moving the soil. It was assumed that the material releasing the smoke was yellow or red phosphorus reacting with oxygen in the air. After a portion of the stockpile was moved, a construction fence was placed around the stockpile to limit access by unauthorized personnel. Plastic sheeting was placed over the soil, and silt fencing was placed around the stockpile to limit soil migration via storm water runoff. The volume of phosphorus in the soil is estimated to be a very small percentage of the soil stockpile, based on visual observations made by the maintenance-of-way crew and by Compliance One staff.

On October 7, 2013, BNSF submitted a letter outlining their proposed plan to handle the soil stockpile. On November 21, 2013, a work plan for managing the soil stockpile was submitted to the Department. A finalized Health and Safety Plan was submitted on February 3, 2014. The work to address the contaminated stockpile soil started in April 2014, and the final grading and seeding of the storm water berm was completed in September 2014. BNSF placed signs along the right-of-way in this area to notify maintenance-of-way crews that soil should not be excavated without notification of the Environmental Remediation Manager. In addition, the location has been delineated on BNSF's internal Geographic Information System.

In April 2015, the consultant made a site visit, and vehicle ruts were discovered in the area that had been revegetated after tilling. The vegetated area that was damaged was regraded and reseeded. The aforementioned signs were posted at the time of the incident. Additionally, the consultant had concrete barricades installed to prevent future trespass

by vehicular traffic. The 2017 annual report was submitted on January 5, 2018. Activities conducted at the site in 2017 included monitoring site conditions, mowing and weeding the area around the concrete pad, and performing annual maintenance on the concrete pad above the buried railcars. The depth to water and total depth of two groundwater monitoring wells, MW-01 and MW-02, were measured during a December 2017 site visit. Both wells were dry and have remained dry since installation. Semiannual site visits to monitor site conditions, mow vegetation, and perform maintenance to the concrete pad will continue in 2018. Periodic water level measurements will be performed over the next year. In the event adequate groundwater is present in a well, groundwater samples will be collected and analyzed for total phosphorus.

General Geologic and Hydrologic Setting:

The site is located in an upland setting. On-site soils are composed of stony and sandy clay residuum. Bedrock is composed of sandstone, chert and dolomite of the Roubidoux Formation. The downstream area is characterized by numerous karst features, such as sinkholes and losing stream segments.

The residual soils in which the tank cars are buried are expected to be highly permeable at depth. Leakage from the tank cars could flow through the gravel and enter surface water at Jacob's Lake downgradient of the site. The potential also exists for downward vertical migration of contaminants directly into groundwater supplies. Any surface discharges ultimately would enter groundwater supplies through the losing drainage downstream of Jacob's Lake. Regional groundwater supplies could be affected if substantial wastes were to be released in a single event.

Public Drinking Water Advisory:

One public water well belonging to Laclede Co. PWSD #1 is located approximately 0.17 miles south of the site. This well is cased 600 feet deep and no site-related impacts are expected. No other public water wells are close to this site.

Health Assessment:

The major contaminants of concern found at

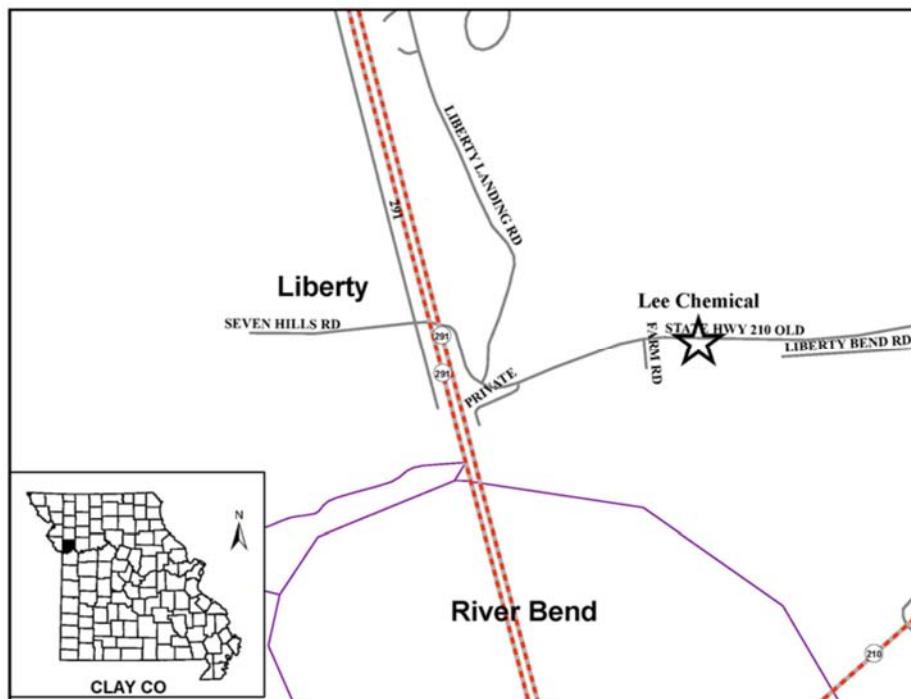
the site are: nitrogen (nitrate), white phosphorus and phosphate. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Three forms of phosphorus were spilled at the site: yellow, red, and a constituent of soda ash containing phosphates. Because the phosphorus disposed at this site is buried, capped, and marked, the only possible route of exposure would be through contaminated groundwater supplies. In 2011, the Missouri Department of Health and Senior Services analyzed two private wells for total phosphorus. Test results showed total phosphorus levels of 16 parts per billion and 17 parts per billion, both of which exceed EPA's threshold for white phosphorus in drinking water of 0.7 parts per billion. In 2013, the Missouri Department of Health and Senior Services sampled specifically for white phosphorus, which is the most toxic of the three forms of phosphorus. One location permitted the Missouri Department of Health and Senior Services to re-sample, and the analysis for white phosphorus showed that it was not detected.

Based on available information, this site poses no current health threat. However, if this site were altered, direct contact or inhalation of vapors from the oxidation of the phosphorus could occur. Because of the highly explosive nature of phosphorus when it comes in contact with air, the hazards associated with removal outweigh the possible health effects of allowing the material to remain buried.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Lee Chemical



Site Name: Lee Chemical

Classification: Class 4

Date of Registry Placement: January 1, 1984

Date of NPL Listing: June 10, 1986

Site Address: South of old Highway 210 and north of the railroad tracks, about 0.7 miles east of Highway 291 in Clay County, Missouri, NE 1/4, SW 1/4, Sec. 28, T51N, R31W, Liberty Quadrangle

Present Property Owner: City of Liberty

Lead Agency: Missouri Department of Natural Resources

Waste Type: Trichloroethene (TCE) and other volatile organic compounds (VOCs)

Quantity: Not determined

Site Description:

The Lee Chemical site, which occupies about 2.5 acres, is located in a rural industrial area on property owned by the city of Liberty since the early 1900s. The Lee Chemical Company leased the property from 1965 to 1975, packaging and distributing commercial and

industrial cleaning solvents and other chemicals. Lee Chemical abandoned the property in 1975, and the building has since been removed. In 1979, the Department discovered TCE and other VOCs, which were once stored on site, were detected in a city of Liberty municipal raw water supply well.

Environmental Problems and Areas of Concern:

Area groundwater is used by the city of Liberty for its municipal water supply. TCE and other VOCs migrated into the on-site soils and the on-site and off-site groundwater. The city of Liberty completed remedial actions under Department oversight over the years reducing the TCE levels in the groundwater and in the municipal water supply. No city of Liberty municipal wells are currently impacted with TCE or other VOCs.

Remedial Actions:

In 1977, the city of Liberty removed about 300 drums of waste from the site. In 1979, TCE was detected in the city of Liberty's raw water supply, and in 1982 the Department determined the Lee Chemical site was the source of contamination. EPA conducted additional clean-up activities on site. The Lee Chemical site was placed on the *Registry* in 1984 and was placed on the National

Priorities List in 1986.

Upon the Department's recommendation, the city of Liberty implemented Interim Response Actions from January 1984 until early 1993. The city of Liberty pumped the on-site Existing Well No. 3 (EW-3) and municipal Production Well No. 2 (PW#2), which was the most contaminated city municipal well, to Town Branch Creek. The discharge was permitted under a Missouri State Operating Permit. The interim response actions created a steady reduction in TCE contaminant levels in all the municipal wells over time, until only TCE was detected in EW-3 and PW#2.

In late 1986, the city of Liberty performed a geophysical study between the site and municipal well field. The study indicated the subsurface was very complex and additional site characterization was needed to better define the hydrogeologic setting. The study concluded that the TCE contamination was manageable, and that expansion of the current well field to meet future demand was feasible.

In August 1988, the Department and the city of Liberty entered into a Consent Agreement to conduct a Remedial Investigation/Feasibility Study (RI/FS). The RI determined that: 1) TCE contamination was present in the soil at depths to 20 feet below ground surface; 2) TCE contamination in groundwater was underlying the site; 3) TCE contamination was present in the out-of-production PW#2 well and in the abandoned on-site EW-3 well; and, 4) VOC contamination was not present in the remaining municipal wells. In August 1990, the city of Liberty completed the Remedial Investigation/Feasibility Study.

On March 21, 1991, EPA signed the Record of Decision. The remedy included: 1) continued extraction of contaminated groundwater; 2) the installation of an on-site in situ aqueous soil washing system; 3) the discharge of the extracted groundwater under a state permit; and 4) the continued monitoring and reporting via progress reports.

In March 1992, the Department and the city of Liberty entered into an Administrative Order on Consent for the Remedial Design/Remedial Action. The city of Liberty began operating the remedial action in January 1994, and the agencies determined on April 26, 1994, the system was functional.

The remedial action system continued to operate until September 30, 2015, when it was shut down to allow a comprehensive soil and groundwater re-evaluation. Groundwater monitoring demonstrated that no city of Liberty municipal wells are impacted with TCE or other VOCs, including the new municipal wells.

The Department completed and EPA concurred on the first Five-Year Review (FYR) Report in May 1999, on the second FYR Report in September 2004, on the third FYR Report in July 2009, and on the fourth FYR Report in July 2014. Based on the data and information obtained during the four reviews, the agencies determined the remedial action was operating as designed and was protective of human health, welfare, and the environment.

An Optimization Evaluation Report was conducted and completed in January 2012. Based on the report, the city of Liberty conducted and completed additional groundwater, surface water and soil investigations. The Remedial Investigation Report was completed and finalized on February 23, 2016. The city of Liberty submitted a focused Feasibility Study Report on December 1, 2017, which is under review to determine the best path forward for the site.

General Geologic and Hydrologic Setting:

The site is located on the alluvial plain of the Missouri River near the northern valley wall. The site is underlain by about 60 to 90 feet of alluvium with the upper 15 to 35 feet of alluvium predominately fine-grained material. The deeper alluvium is made up mostly of coarse-grained sands and gravels.

The water table is within 10 to 20 feet of the surface, and the flow direction is to the east-southeast. All of the city's municipal wells are hydraulically downgradient of the site; therefore, the downgradient flow velocity is increased by the influence of the municipal wells.

Bedrock structure, type, and erosional configuration may influence the transportation of contaminants that have migrated downward to the base of the alluvium. Geophysical and borehole data indicate that the bedrock surface, while quite uneven, slopes generally

to the south and east. The uppermost bedrock unit below the site is predominantly shale; however, it may also include thin sandstones and/or limestones.

Public Drinking Water Advisory:

The city of Liberty operates eleven wells that draw from Missouri River alluvium less than one mile east and south of the site. Remediation activities have reduced site-related contamination significantly as evidenced by a reduction of TCE and other VOCs. Continued tracking of annual monitoring trends helps ensure site-related contamination does not impact the wells is recommended.

Health Assessment:

The major contaminants of concern found at the site are: 1,1-dichloroethene (1,1-DCE), cis -1,2-dichloroethene (cis-1,2-DCE), 1,1,1-trichloroethane (1,1,1-TCA or TCA), and TCE. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Ingestion of contaminated groundwater from the municipal well field was the main route of exposure. In the past, significant exposure occurred for individuals using the public water supply. Interviews with area residents failed to uncover any patterns of adverse health effects consistent with exposure to contaminants known to be present at the site. Remedial actions at the site have significantly reduced VOC contaminant levels in the groundwater and are continuing.

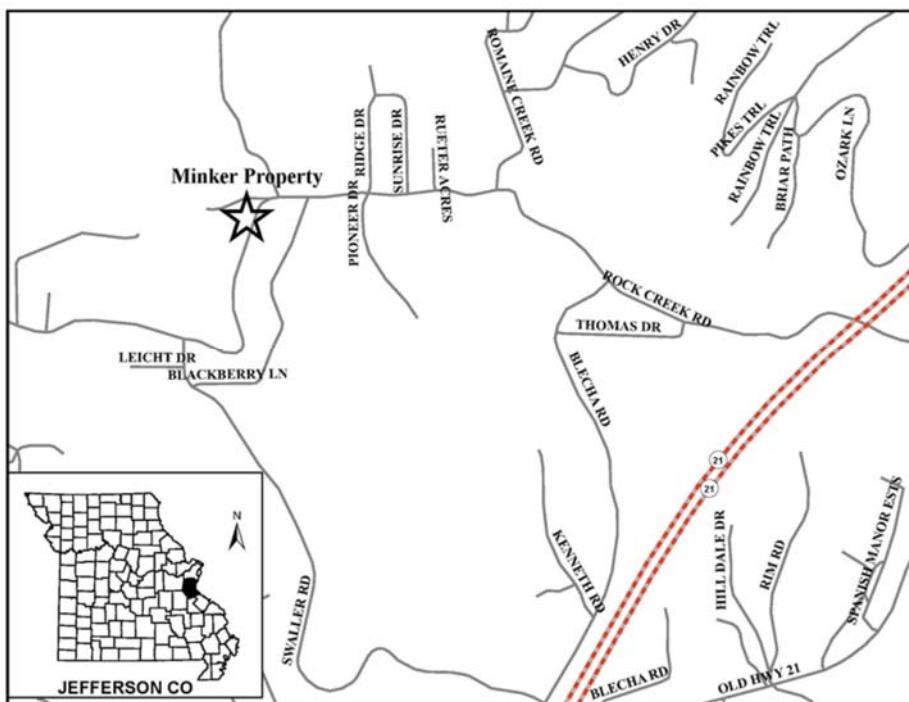
As part of the site's third Five-Year Review and at the Department's request, the Missouri Department of Health and Senior Services reviewed site information and provided a risk assessment for the site. Two contaminants, vinyl chloride and acetonitrile, neither of which had been reported during the previous two five-year reviews, were incorporated into the risk assessment. Although the remedy is functioning as intended and many wells show non-detects or substantial reductions in the levels of contaminants of concern over the period under review, vinyl chloride, a product of the biological reduction of TCE, was found to exceed EPA's drinking water Maximum Contaminant Level in two site wells.

Acetonitrile, reported in site wells since 2006, has only modest toxicity. However, it can be metabolized to produce hydrogen cyanide, which is the source of its observed toxic effects. Along with TCE, acetonitrile contributed substantially to the non-carcinogenic risk at the site. Reports of relatively high detection levels of vinyl chloride, acetonitrile, and TCE would seem to suggest the need for further/continued monitoring of site contaminants.

Based on available information, a potential health risk exists due to the presence of VOCs in on-site soils, as well as in on-site and off-site groundwater.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Minker Property



Site Name: Minker Property

Classification: Class 4

Date of Registry Placement: June 14, 1984

Date of NPL Listing: Sept. 8, 1983

Site Address: 4037 West Rock Creek Road, Hillsboro, Jefferson County, Mo

Present Property Owner: Carl and Betty Fisk Trust

Lead Agency: Missouri Department of Natural Resources

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

Quantity: Not determined

Site Description:

In 1971, a private contractor sprayed oil containing TCDD in three horse arenas in eastern Missouri as a dust suppressant. In 1974, TCDD contaminated soil from the Bubbling Springs horse arena was excavated and used as fill material in a residential area approximately 1.5 miles southwest of the arena. One of the affected residential properties was designated as the Minker

Property site based on the owner's name at that time. EPA conducted a removal action at each of the affected properties to excavate the TCDD contaminated soil and replace it with clean fill. At the Minker property, it was not possible to excavate all the contamination, and some TCDD-contaminated soil remains at depth. Therefore, the site was placed on the Registry.

On September 24, 2003, the Minker Property was sold to a private citizen. The property has not been developed or otherwise changed since that time.

Environmental Problems and Areas of Concern:

The site should pose no environmental risk, since the dioxin contamination remains at depth and is covered by 4 feet of clean soil. The Department will continue to inspect the site annually to verify that the land use has not changed and that the area is not disturbed. A fence surrounds the site, with a locked gate to prevent public access.

Remedial Actions:

In 1988, EPA completed the cleanup at the Minker Property site. TCDD-contaminated soil was excavated to a 4-foot depth before bedrock was encountered and excavation

halted. EPA's post-excavation sampling of this area showed levels of TCDD as high as 266 parts per billion remained. EPA filled in and capped the excavated area with clean top soil, and installed permanent survey markers to delineate the area where contamination was left at depth. Erosion control walls were constructed in the area where the contamination remains. The excavated material temporarily was stored on site in five storage buildings before being transported to a thermal treatment facility at Times Beach, Missouri, for incineration.

The Minker Property site is one of 27 eastern Missouri dioxin sites subject to a consent decree entered in federal court on December 31, 1990. In accordance with the decree, EPA constructed a thermal treatment unit at Times Beach to destroy the TCDD-contaminated materials from this site. This included 26,420 tons of bagged materials that EPA transported from the Minker Property to the Times Beach Thermal Treatment Facility between December 1996 and February 1997. The temporary storage buildings on site were removed as part of the cleanup, and site restorations are now considered complete.

General Geologic and Hydrologic Setting:

The site is located in an upland area, with steep slopes adjacent to streams. Surface drainage from the site enters Romaine Creek, which loses water to the subsurface.

The surficial materials beneath the site consist of several feet of wind-deposited, silty clay, or loess, over stony clay that was derived from the weathering of bedrock. The bedrock is deeply-weathered limestone.

Water-tracing studies indicate that water lost to the subsurface in the upper reaches of Romaine Creek reemerges at two springs in the lower portion of the watershed. The water first reemerges at Mastis Spring, located about 1 mile north of the site. A portion of the water discharged from Mastis Spring is, in turn, lost to the subsurface, emerging at Bubbling Spring, about 1 mile farther downstream.

Public Drinking Water Advisory:

The nearest public water well to this site lies over 1 mile southwest and serves a mobile home park. Impacts to this well from the

Minker site are not expected.

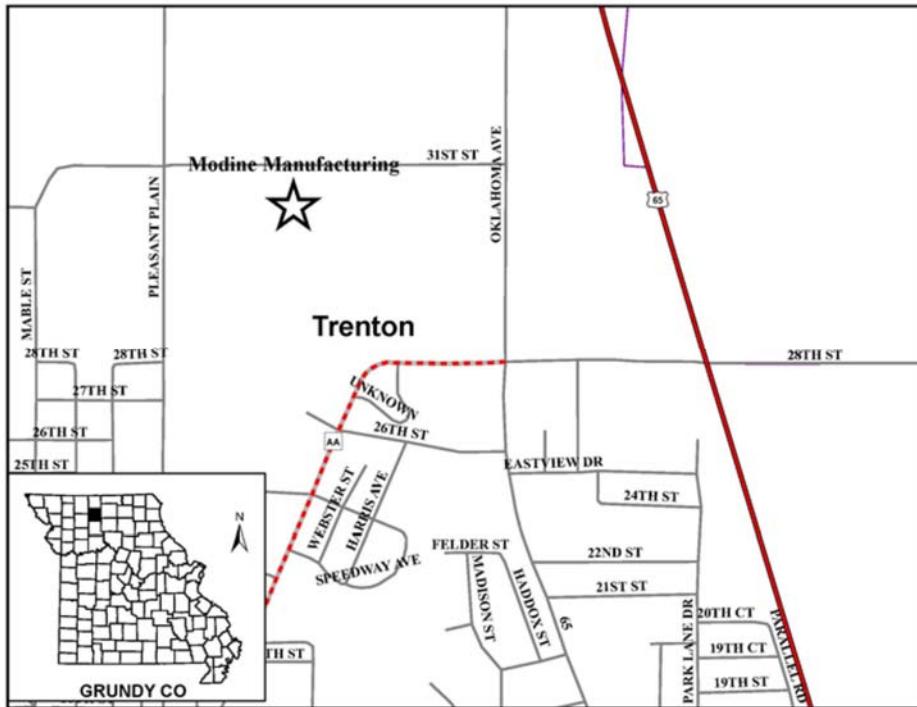
Health Assessment:

TCDD is the chemical of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

The Missouri Department of Health and Senior Services recommends that, because residual TCDD remains at this site, monitoring continues to prevent potential erosion and disturbance, which could lead to potential exposure. Maintaining the cap will eliminate potential direct exposure to contaminated soils. Currently, no health effects are expected because exposure is not occurring. If site conditions were to change such that exposure to contaminated soils occurs, adverse health effects could result.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Modine Manufacturing



Site Name: Modine Manufacturing

Classification: Class 4

Date of Registry Placement: January 8, 1996

Site Address: 822 Industrial Drive, Trenton, Grundy County, Mo.

Present Property Owner: Modine Manufacturing

Lead Agency: Missouri Department of Natural Resources

Waste Type: Heavy metals and chromium

Quantity: Not determined

Site Description:

Modine Manufacturing Company (Modine) has manufactured truck and car radiators at the present location since 1968. Modine's disposal practices in the late 1970s led to soil contamination in one portion of the facility. This area, a former sludge pit, is contaminated with a variety of metals. Modine disposed of approximately 36,000 gallons of metal hydroxide sludge in this pit from 1971 to 1976.

Modine disposed of metal hydroxide sludge

through the Trenton sanitary system from 1968 until 1971. In 1971, Modine constructed an unlined pit, about 75 by 16 feet and 10 feet deep, to contain the metal hydroxide waste. Modine used the pit from 1971 until 1976. In 1976, Modine built an addition to the manufacturing facility, which included a wastewater treatment facility.

When Modine ceased using the pit for metal hydroxide waste, the pit was allowed to dry. Modine then used soils and construction debris as fill material over the dried waste.

Environmental Problems and Areas of Concern:

On June 22, 1994, EPA completed a Site Inspection that included collection of soil samples from the former sludge pit. Three of the six samples exceeded the maximum regulatory limit for the Toxicity Characteristic Leaching Procedure for chromium. The samples detected chromium to about 5 feet below the surface. Modine's contractor collected several soil borings downgradient of the sludge pit area with Department oversight on September 9, 1995. The sample results indicated that no significant migration of hazardous waste from the sludge pit area had occurred. Surface water and groundwater are potentially at risk of contamination if metals migrate from the capped pit.

Remedial Actions:

Modine capped the area with clay and topsoil in October 1998. They seeded the area, and vegetative cover is now well established and well maintained. No additional remedial action has occurred. The Department completed the Fiscal Year 2018 Registry annual inspection on May 16, 2018, and noted the capped area remains in good condition and is well maintained.

General Geologic and Hydrologic Settings:

This site is located on the Dissected Till Plains of northern Missouri. The area is blanketed by a layer of low-permeability till, consisting of a poorly-sorted mixture of clay to boulder-sized particles. The till is covered by a thin mantle of loess, or wind-deposited silt.

Bedrock composed of shale, limestone, clay, and sandstone is present at a depth of 50 to 100 feet below the surface. Gravel layers within the till provide the primary source of groundwater for this area. Yields from wells in the till are generally low, though very high yields may be obtained from pre-glacial stream deposits. These types of stream deposits are known to exist east of the city of Trenton at a distance of more than 2 miles from the site.

Water from the consolidated bedrock is highly mineralized, and the mineral content increases with depth. Wells drilled to a moderate depth into bedrock may yield a limited amount of water that is of marginal quality.

Public Drinking Water Advisory:

The City of Trenton obtains water from the Thompson River which is unaffected by this site. No anticipated impacts from this site to public water sources.

Health Assessment:

Contaminants of concern at this site include cadmium, chromium, copper, lead, and zinc. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

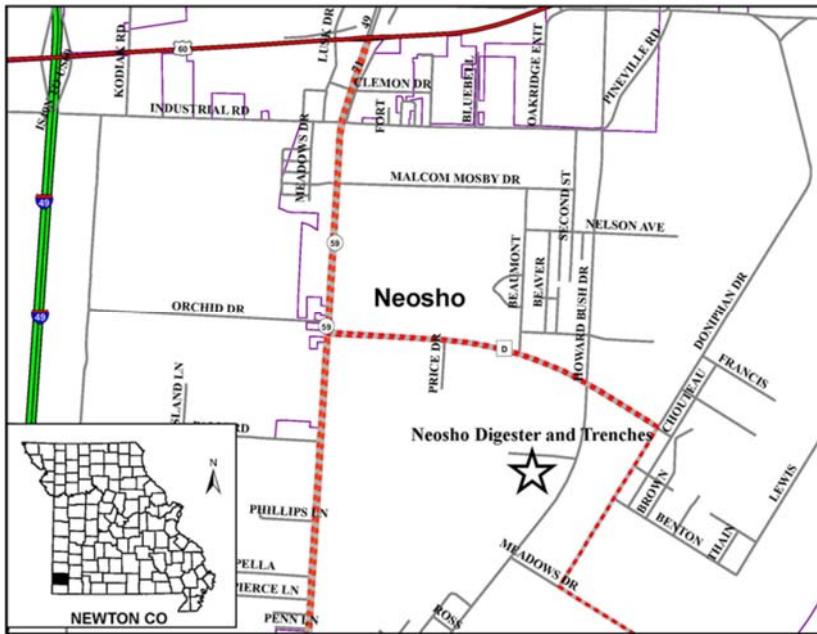
The metals present at the site are mobile and

may migrate off site in groundwater or surface water if the cap material erodes or is damaged. Consequently, both surface water and groundwater are at risk. A May 1998 investigation by the Missouri Department of Health and Senior Services found no private wells nears the site.

No significant off-site migration of hazardous wastes has occurred. Surface water run-off has been identified as the only potential exposure media if the hazardous waste is exposed to the surface. Based on available information, this site does not pose a health risk as long as the site continues to be well maintained and the cap remains intact.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Neosho Digester and Trenches



Site Name: Neosho Digester and Trenches

Classification: Class 4

Date of Registry Placement: January 9, 1984

Site Address: Neosho, Newton County, Missouri, part of NE 1/4, NE 1/4, Sec. 16, T. 24N, R. 32W, Neosho West Quadrangle

Present Property Owner: City of Neosho

Lead Agency: Missouri Department of Natural Resources

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and 2,4,5-trichlorophenol (TCP)

Quantity: Not determined

Site Description:

The site is an abandoned concrete sewage digester used in the past by the Fort Crowder Military installation. In 1971, 225,000 gallons of contaminated rinse water and wastewater from the Northeastern Pharmaceutical and Chemical Company (NEPACCO) in Verona was deposited into the digester for use in treatability studies conducted by the Neosho wastewater school. In 1978, the wastewater school dumped scrap material into the

digester, causing it to overflow on the north and east sides. The wastewater school excavated a trench next to the digester, and the spilled material was buried in the trench. In 1981, EPA sampled the digester and documented TCDD at concentrations up to 60 parts per billion and TCP at concentrations up to 250,000,000 parts per billion in the center and at the bottom of the digester at a 20.5- to 24-foot depth. The city of Neosho capped the digester to prevent water infiltration and exposure. A chain-link fence restricts access, and areas of poor vegetation have had new growth established. The city routinely mows the site.

This site is located about 3 miles south of Neosho, Missouri, in a relatively rural area. About 70 farmhouses are located within a 7-mile radius of the site.

Environmental Problems and Areas of Concern:

The possibility for groundwater contamination exists due to soil permeability. Surface water contamination from erosion is also a possibility.

Remedial Actions:

In June 1981, EPA collected samples from Buffalo Creek, both upstream and downstream, and from four local private wells.

None of the samples detected either TCDD or TCP. As part of a June 1984 EPA consent order, the city of Neosho capped the trench area and installed four vertical test wells around the site's perimeter in December 1984 to be used for soil sampling and possibly groundwater monitoring. The city conducted subsurface investigations to determine engineering properties of subsurface soils. In June 1988, EPA drilled at an angle underneath the digester to check for TCDD contamination in the soil below the digester. No TCDD was detected in the samples, demonstrating that no leaks or cracks are present at the base of the digester. About 0.5 ppb of TCDD was found in the trench to the east of the digester. The EPA consent order requires the city to maintain the clay cap and to restrict site access. No additional cleanup or groundwater monitoring was completed. The Department completed its Fiscal Year 2018 annual inspection on April 26, 2018, and the report noted nothing of significance. In Fiscal Year 2019, the Department and EPA will discuss the city removing and properly plugging the vertical test wells.

General Geologic and Hydrologic Setting:

The site is located in an upland setting with surface drainage to the west. The topography and geology are typical of the Springfield Plateau.

Soils range from silty clay to silty and clayey gravel. Bedrock is Mississippian-age, cherty limestone. Permeability in this limestone is high along solution-enlarged openings. Springs and losing-stream segments are located in the upland drainages. However, sinkholes have not been observed in the site's vicinity, and no record exists of catastrophic sinkhole collapse in the immediate area.

Water lost to the subsurface recharges the shallow aquifer, which consists of cherty limestone. This aquifer is used as a water supply for individual homes in rural areas. It is separated from the deeper aquifer by a confining layer, the Chattanooga Shale. The deeper aquifer is the source for some public water supplies in the area and also is tapped by some of the deeper private wells.

Rainfall in the area near the digester percolates through the underlying gravelly soil and migrates through fracture openings into bedrock. Some of the water is later

discharged at nearby springs, and some might be pumped from wells that are open to the shallow aquifer. Any water-soluble or liquid contaminants present outside the digester would follow the same pathway. The deeper aquifer likely has not been affected; however, connections between the upper and lower aquifer may exist due to the presence of wells that are open to both aquifers.

Public Drinking Water Advisory:

Although area geological conditions may allow rapid shallow groundwater movement, the closest public water well to this site is nearly 2 miles away. No impacts to public water sources are expected.

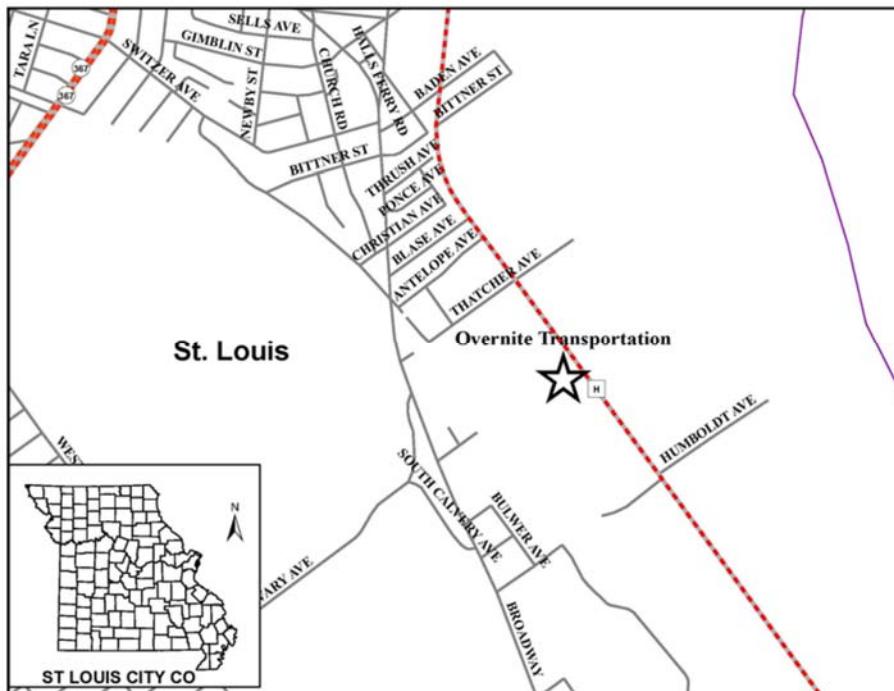
Health Assessment:

TCDD is the chemical of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

TCDD is not leaking from the digester. Based on available information, a threat to public health does not exist at this time, as long as the site is mowed routinely, fenced and gated, and visually inspected for erosion and cap deterioration.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Overnite Transportation



Site Name: Overnite Transportation

Classification: Class 4

Date of Registry Placement: January 22, 1992

Site Address: 7455 Hall Street, St. Louis, Mo

Present Property Owner: UPS Freight Inc.

Lead Agency: Missouri Department of Natural Resources

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

Quantity: Not determined

Site Description: The site is a 10-acre parcel of land located in an industrial area of St. Louis city. Approximately 57,000 square feet of the 10-acre parcel is covered by buildings, with the remaining portions paved. The property was owned by Pacific International Express in the late 1960s and early 1970s. During that time, the owner hired a contractor to spray the then gravel-covered lot with waste oil for dust suppression. Some of this oil had been mixed with chemical manufacturing waste containing TCDD. The same contractor conducted similar spraying in a number of

other locations in eastern Missouri during this time period. Overnite Transportation Company (now UPS Freight Inc.) acquired the property in 1981 and used it as a trucking transportation hub.

As part of a regional assessment of areas potentially contaminated by TCDD, the EPA conducted sampling at the Overnite Transportation site in 1990 and detected levels of TCDD above the health-based benchmark of one part per billion. EPA subsequently capped the contaminated material with a six inch asphalt cover. The property currently is used by the Midwest Shingle Recycling Company to store, grind, and recycle waste tear-off asphalt shingles. The property is fenced and gated.

Environmental Problems and Areas of Concern:

Deterioration or disturbance of the asphalt cap could result in direct exposure to TCDD-contaminated material.

Remedial Actions:

In 1990, EPA collected samples from within a 72-cell sampling grid established across the parcel. TCDD was detected in six of the grid cells at concentrations between 1 and 5 parts per billion. These six grid cells were located in

an area approximately 50 feet southwest of the main building (still extant). Five additional grid cells, located further to the southeast, contained TCDD between 1 and 2 parts per billion. TCDD concentrations were below 1 part per billion in the remaining 61 grid cells.

The Overnite Transportation site is one of 27 eastern Missouri dioxin sites subject to a Consent Decree entered in Federal District Court on December 31, 1990. In accordance with the Consent Decree, EPA constructed a thermal treatment unit at Times Beach, Missouri, to treat the TCDD-contaminated materials excavated from these sites. On July 21, 1995, EPA completed an Engineering Evaluation/Cost Analysis. The purpose of the analysis was to select the remedy and cleanup criteria for 27 eastern Missouri dioxin-contaminated sites. The cleanup criterion for TCDD at industrial and commercial properties such as the Overnite Transportation site was 20 parts per billion. Since TCDD concentrations documented at this site were all below 20 parts per billion, no excavation was conducted. In order to prevent future contact with the contaminated material at the site, a 6-inch asphalt cap was placed across the property.

The Department conducts annual inspections of all sites listed on the Registry. The most recent inspection at Overnite Transportation was conducted on May 31, 2018. The inspector noted that due to the presence of asphalt shingles piles, the condition of the cap could not be assessed for much of the site.

General Geologic and Hydrologic Settings:

The site is located 0.5 mile west of the Mississippi River on the western edge of the flood plain. The site is protected from the river by an Army Corps of Engineers flood wall. The topography is flat, and the landscape is dominated by industrial development. The entire lot surrounding the buildings is paved with asphalt and concrete.

Surficial materials along Hall Street are a mixture of fill, alluvium, and alluvial-type soils. The fill is composed mainly of construction debris deposited in low-lying areas during the 1930s to raise the land elevation. Detailed locations of fill are unknown. The Mississippi River valley alluvium in the vicinity of the site is expected to be 45 feet thick or less and consist of silt with some sand. Coarser sands

are expected to predominate at depth. Permeability values across the flood plain can change significantly from layer to layer, especially in the near-surface units. Detailed investigation would be needed to evaluate the specific subsurface conditions at the site, but soil permeability is expected to be moderate to high.

Bedrock beneath the site is Mississippian-age Ste. Genevieve Limestone, which is a massively-bedded, sandy, clastic limestone, with some layers of chert and some sandstone lenses occurring locally. The Ste. Genevieve Limestone, and a sequence of similar Mississippian-age carbonates beneath it, are not favorable for the development of drinking water wells. High concentrations of naturally-occurring, dissolved solids in the area render the bedrock aquifers unsuitable for most purposes.

The water table is less than 20 feet from the ground surface at normal river levels. Due to its extremely low water solubility, TCDD is not expected to migrate readily into the groundwater.

Public Drinking Water Advisory:

The City of St. Louis obtains water from the Missouri and Mississippi rivers upstream from this site. No impacts to public water sources are expected.

Health Assessment:

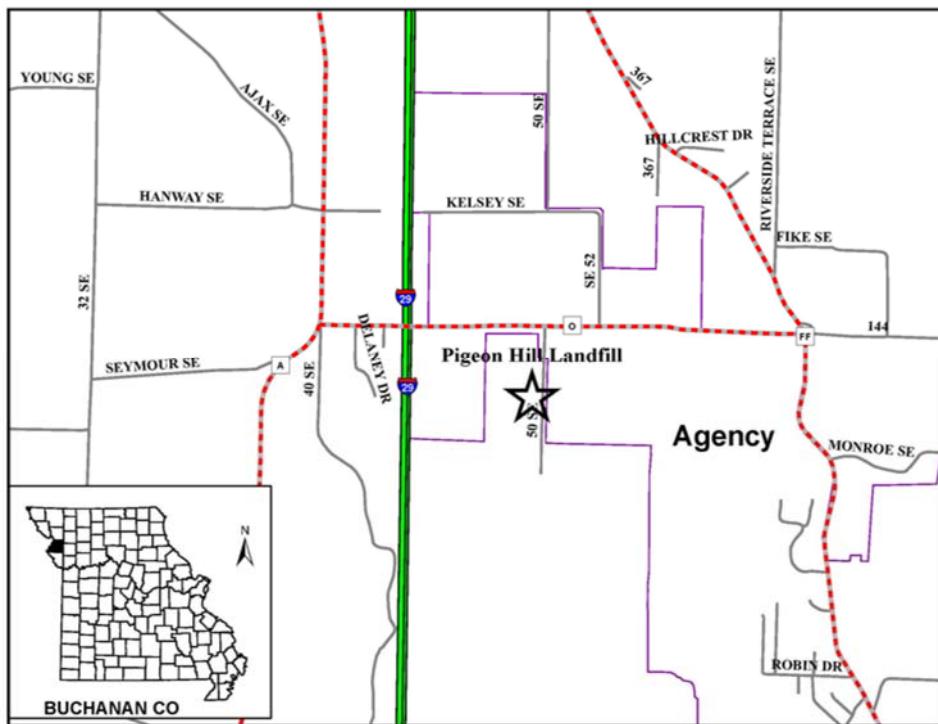
TCDD is the chemical of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

The TCDD-contaminated material beneath the asphalt cap poses no direct-exposure concern at the site, and migration through surface water runoff or groundwater infiltration is unlikely, due to the extremely low water solubility of TCDD. Should the cap deteriorate or be disturbed, potential exposure routes of concern would include ingestion of the contaminated soil, inhalation of contaminated dust particles, and dermal contact with the contaminated soil or dust. Removal or deterioration of the cap could result in exposure of the contaminated material, as well as erosion and migration of material off site through surface water runoff. No health

risk exists at this site as long as the asphalt cap is maintained.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Pigeon Hill Landfill



Site Name: Pigeon Hill Landfill

Classification: Class 4

Date of Registry Placement: June 14, 1984

Site Address: Ten miles south of St. Joseph, bordering the Northeast corner of the Pigeon Hill Wildlife Area, St. Joseph, Buchanan County, SE 1/4 of the SW 1/4 of Sec. 12, T. 56N, R. 35W, St. Joseph South Quadrangle

Present Property Owner: Buchanan County (Trustee)

Lead Agency: Missouri Department of Natural Resources

Waste Type: Heavy metals, pesticides, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs)

Quantity: The landfill contains an estimated 100 tons of industrial wastes.

Site Description: The site consists of a 36-acre, closed landfill. Partially-wooded ridges and valleys are present to the north and south. The site is directly north and adjacent to the Missouri Department of Conservation Pigeon Hill Conservation Area. The active 160

-acre St. Joseph sanitary landfill is located across the road to the southwest. The Pigeon Hill Landfill received a mixture of residential, commercial, and industrial waste between 1969 and 1978, when operations ceased. The Department estimates that more than 100 tons of industrial wastes may have been deposited in the landfill over that period. Contaminants include heavy metals, pesticides, solvents, and various inorganic wastes. Buchanan County took ownership of the property in 1994 following the failure of the previous owner, Frank Norris, to pay taxes.

Environmental Problems and Areas of Concern:

Potential for surface and groundwater contamination exists. The site is located next to the Pigeon Hill Conservation Area. Prior to Buchanan County's landfill closure activities in 1999, leachate from seeps along the landfill's southern portion discharged into a drainage leading into Pigeon Creek, which flows through the conservation area. The Department's environmental sampling has detected a variety of contaminants in the leachate and in surface water near a leachate seep. Contaminants include the heavy metals arsenic, barium, cadmium, chromium, nickel, and zinc; the VOCs acetone, cyclohexane, xylene, and carbon disulfide; pesticides and

herbicides including parathion, chlordane, heptachlor, 2,4-dichlorophenoxyacetic acid (2,4-D), 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T), and hexachlorobenzene; and the SVOCs pyrene, fluoranthene, bis(2-ethylhexyl)phthalate, and 2,4-dichlorophenol. The Department detected several of these contaminants in landfill soil, which may be exposed if the landfill cover is not maintained. Leachate from the landfill also has the potential to impact groundwater.

Remedial Actions:

All remedial activities at the site have been conducted by Buchanan County. In August 1995, a runoff collection pond was constructed in the northeastern portion of the landfill to capture leachate surfacing in that area. This area was later addressed through regrading and capping activities in 1999, and leachate is no longer an issue. As part of the landfill's 1999 closure, grading, shaping, and smoothing activities were conducted, and a storm water/leachate collection pond was constructed at the southern end of the landfill. Leachate water is pumped regularly from the collection pond and taken to St. Joseph's wastewater treatment plant. A final soil cap and vegetative cover is in place, and fencing surrounds the entire site.

Contaminated landfill leachate no longer leaves the site. The Department determined that Buchanan County met all closure and enforcement requirements for the Pigeon Hill Landfill. The city of St. Joseph must continue to follow its management plan to repair the landfill cover when needed and continue to prevent leachate from leaving the landfill property. The Fiscal Year 2018 annual inspection was completed by the Department on May 17, 2018. The inspection report noted nothing of significance.

General Geologic and Hydrologic Setting:

The on-site soils initially consisted of about 20 feet of loess underlain by variable thicknesses of glacial till. However, site disturbance altered the soil's natural conditions. Unconsolidated material directly beneath the landfill is expected to consist of about 0 to 10 feet of silty clay, underlain by sandy clay at depths of 10 to 15 feet below the surface. The sandy clay reportedly contains interbedded sands, ranging from 1 to 6 feet in thickness at depths of 25 to 70 feet. These interbedded sand

lenses contain appreciable amounts of shallow groundwater and could be affected by site contamination.

The uppermost bedrock beneath the site is the Amazonia Limestone. Because the till and underlying bedrock typically display very low permeability, there is little likelihood that contaminants will migrate into deep groundwater supplies. Furthermore, deep groundwater supplies in this area normally are marginal in quantity and quality.

Shallow, large-diameter wells may have been dug on or near the facility and could still exist on site. If abandoned wells were not plugged properly, groundwater supplies could be affected by contaminant migration down boreholes.

Public Drinking Water Advisory:

The City of St. Joseph obtains water from alluvial wells along the Missouri River and are unaffected by this site. No impacts to public water sources are expected.

Health Assessment:

Numerous chemicals, including some carcinogens, are present in leachate from the Pigeon Hill landfill. The major contaminants of concern at the site are: arsenic, barium, bis(2-ethylhexyl)phthalate, cadmium, chromium, fluoranthene, manganese, nickel, pyrene, 2,4-dichlorophenol, and zinc. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

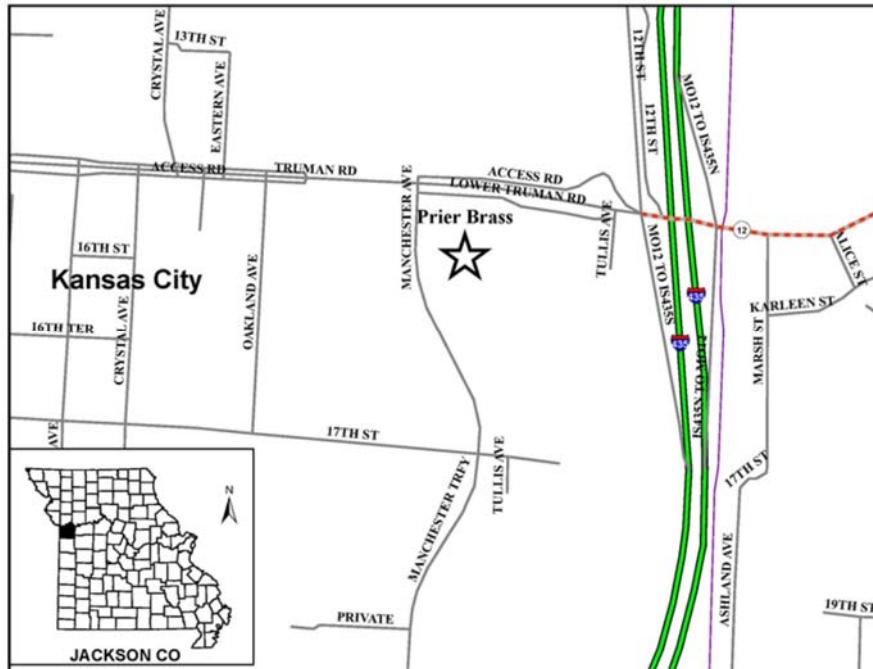
The landfill is now covered with clean soil and has an established vegetative cover. Failure to maintain the landfill cap or to capture leachate and prevent it from discharging from the site may result in human exposure to contaminants in surface water and soil.

Groundwater in the aquifer beneath the site may be at risk to contamination by leachate. There may be some older private drinking water wells in the area. However, a public water system now exists in the area and is used by most nearby residents.

For more information regarding health-related issues, please contact the Missouri

Department of Health and Senior Services,
P.O. Box 570, Jefferson City, MO 65102,
573-751-6102.

Prier Brass



Site Name: Prier Brass Manufacturing Company

Classification: Class 3

Date of Registry Placement: July 14, 1986

Site Address: 7801 Truman Road, Kansas City, Jackson County, Mo.

Present Property Owner: WCA-KC Transfer, LLC

Lead Agency: U.S. Environmental Protection Agency

Waste Type: Lead and cadmium

Quantity: Not determined

Site Description:

Located in an industrial area of Kansas City, this facility formerly housed a manufacturer of various brass products. The manufacturer operated from 1907 until 1985 before going bankrupt. Lead-contaminated foundry wastes and baghouse dust were dumped here over a period of several years. A March 1993 fire at the abandoned facility destroyed roof structures and building interiors.

In 1997, CST, L.L.P. purchased a portion of

the site. Garages were constructed for the maintenance of vehicles and other uses, such as repairing skids. Extensive grading with gravel cover was performed on the eastern section, and new concrete paving was poured in several areas. Access to the property is restricted by a fence and gate.

Environmental Problems and Areas of Concern:

The potential for groundwater contamination at the site exists. The Big Blue River rechannelization project by the U.S. Army Corps of Engineers, which began in 1996 and completed in 2005, moved the channel away from the facility. A new segment of Manchester Street, was constructed between the west side of the facility and the Big Blue River.

Remedial Actions:

In 1989, the Missouri Department of Natural Resources conducted both a Preliminary Assessment in 1988 and a Site Inspection of the site. Extraction Procedure toxicity tests revealed that the foundry sand contained unacceptable levels of leachable lead. The baghouse dust contained unacceptable levels of leachable lead and cadmium. The Department referred the site to EPA to conduct a removal assessment. EPA sampled

and assessed the site to determine the extent of contamination. EPA completed a removal action February 1996. Contaminated material was removed, stabilized, and shipped off site for disposal. EPA designated 1,000 parts per million as the lead action level. The excavated areas were filled with clean fill. Additional cleanup actions are not planned.

Contaminated foundry wastes remain under a portion of the building. EPA and the Agency for Toxic Substances and Disease Registry determined that leaving the waste underneath the building is protective of human health. On June 16, 1997, EPA and CST, L.L.P., entered into a Prospective Purchaser Agreement for a portion of the Registry site that CST purchased.

In 1997, CST installed a four-inch layer of gravel. More gravel has been added over the years as the original gravel was pressed down into the ground. In 1997, the Department approved a Change of Use request made by CST for development of the site as an operational base for a construction company that included a material recovery facility. The request adequately addressed human health and environmental concerns related to the proposed Change of Use. As a part of this Change of Use request, a truck weigh station was installed, which required excavation into the previously buried baghouse wastes. A small building used for an office was constructed in this area adjacent to the Big Blue River channel.

CST sold its interest in the building to Manchester Transfer in 2004. The Department's Solid Waste Management Program issued the owner in succession, Manchester Transfer, LLC, a solid waste permit (# 609504) to operate a transfer station in May 2005. In 2006, Manchester Transfer removed a large smoke stack along with the east side section of the building and the rear dock.

In 2012, Manchester Transfer, LLC sold the property to C Rae Properties, LLC. EPA's Covenant Not to Sue (formally known as a Perspective Purchaser Agreement) was transferred to C Rae Properties LLC December 2012. In 2014, WCA-KC Transfer, LLC purchased the property. EPA transferred the existing agreement and Covenant Not to Sue to WCA-KC Transfer LLC, but added language that required the new owner to

convert to the Uniform Environmental Covenants Act (UECA) process during their ownership (i.e., before the property is transferred again).

Both the original building and the building that stood over the area of interest have been demolished as of April 2015. The existing floor slabs of both buildings have been left intact. All of the structures that have been removed still have their foundation remaining. The outside walls of the original building were removed in Fiscal Year 2017.

In May 2017, WCA submitted a permit modification request to the Department. The submittal was for a permit modification to construct an addition at the north and west ends of the Kansas City Transfer building. It was approved January 2018.

The Fiscal Year 2018 Registry annual inspection was completed by the Department on April 19, 2018. The concrete slab continues to cover the contamination that remained following the removal action.

General Geologic and Hydrologic Setting:

The site is located next to the Big Blue River. On-site soils are a mixture of fill material, underlain by alluvial deposits of clay, silt, sand, and gravel. Bedrock at depth is composed principally of interbedded shale and limestone. Typically, the bedrock is characterized by low permeability.

The potential exists for off-site contamination on the surface due to the proximity of waste materials to the Big Blue River. Floodwaters and surface runoff may wash these contaminants into the river. However, the potential for off-site migration via surface water decreased with the completion of a removal action.

Depth to the water table is expected to fluctuate with the river stage, but is probably between 10 and 25 feet below the flood plain surface. Contaminants in solution potentially could affect the shallow groundwater supplies of the Big Blue River alluvium. Although the alluvial sediments under the area of waste disposal have not been fully characterized, the effects of contamination on shallow groundwater likely are extremely localized.

Public Drinking Water Advisory:

No public water sources are located in the immediate vicinity of this site, and no site-related impacts to public water sources are expected.

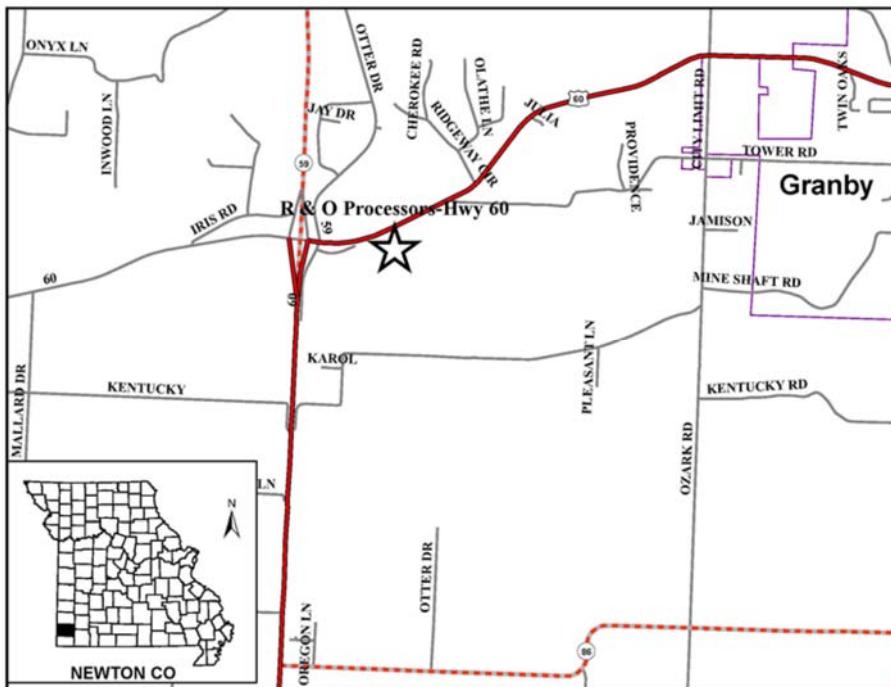
Health Assessment:

Lead and cadmium are the chemicals of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Based on actions taken at the site, exposure to contaminated material is unlikely; therefore, the potential health risk is low as long as the area remains graveled and paved.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

R & O Processors—Hwy 60



Site Name: R & O Processors—Hwy 60

Classification: Class 4

Date of Registry Placement: October 10, 1991

Site Address: About three miles west of Granby on Highway 60 in Newton County, Missouri, NE 1/4, NW 1/4, Sec. 10, T. 25N, R. 31W, Granby Quadrangle

Present Property Owners: Robert W. Moffet

Lead Agency: Missouri Department of Natural Resources

Waste Type: Heavy metals and cyanide

Quantity: Not determined

Site Description:

The site is located in a rural, light industrial area. About 50 residences are located within 1 mile of the site, and 25 residences are within 0.5 mile of the site. During its operation from 1981 to 1990, R & O Processors performed various metal-finishing processes, including zinc, brass, copper, chromium, and nickel plating. In 1990, the owners filed both business and personal bankruptcy and abandoned the facility. The Department

documented about 30,000 gallons of metal-plating waste and sludge, characterized as hazardous waste, contained in abandoned on-site concrete tanks, vats, and drums. Building structures, equipment, and surface soils also were contaminated.

Environmental Problems and Areas of Concern:

Potential shallow groundwater contamination is of concern; however, the contamination sources have been removed. The closest residence is adjacent to the site and within 50 yards of the process building. This residence and most of the surrounding residences obtain water from private wells.

The site is near Shoal Creek, which the State has designated as a Whole-body Contact Recreational stream. Shoal Creek is located about 1.5 miles northwest and upgradient of the site.

On April 21, 2003, the Department conducted soil sampling that showed low concentrations of metals, pentachlorophenol (PCP), and toluene on the former processing building's east side.

Remedial Actions:

In 1991, EPA conducted a removal

assessment and determined that the surrounding population, surface waters, and groundwater were threatened by dangerous levels of heavy metals and cyanide contained in several hundred drums, tanks, and vats of plating process waste. Included in these wastes were spent acidic stripping and rinse solutions and caustic, sludge byproduct wastes.

In 1992, EPA contractors completed removal activities during which 20 waste streams, totaling 600 drums, were segregated and staged for disposal. A total of 1,220 tons of contaminated soil waste were excavated and transported to a hazardous waste landfilled off site. The site was restored by the application of 750 cubic yards of topsoil, followed by seed and straw. Fifty tons of scrap metal were decontaminated on site and shipped to a local scrap dealer. Contaminated scrap wood (mostly pallets) was shredded on site and blended with contaminated soil for disposal. The on-site operations building was sandblasted and pressure washed. Twenty thousand gallons of generated wastewater were disposed off-site.

The Department completed its Fiscal Year 2018 Registry annual inspection on May 10, 2018. The inspection report noted nothing of significance.

General Geologic and Hydrologic Settings:

The site is located on a ridgeline, where the topography is nearly flat to gently sloping. Surface runoff flows to Dry Branch or another unnamed tributary of Shoal Creek. Shoal Creek, which is a gaining stream, is located about 1.5 miles northwest of the site. Many of the tributaries to Shoal Creek lose flow to the subsurface.

Surficial materials are expected to be 30 to 40 feet thick and consist mainly of cherty, red clay residuum. The residuum is a weathered product of the underlying cherty limestone bedrock and exhibits typically a moderate to high permeability. The chert content of the residuum varies, but it is often present as a relict structure, retaining its stratigraphic position.

Bedrock beneath the site is Mississippian-age Burlington-Keokuk Limestone, a medium- to coarse-grained limestone with chert beds and nodules. Weathering of the bedrock has

resulted in solution-enlarged fractures, bedding planes, caves, sinkholes, and springs. Such karst features have been observed in the area, but are not known to exist beneath the site.

The uppermost aquifer comprises the Burlington-Keokuk Limestone and the underlying Elsey and Reeds Spring formations. All of these units are cherty limestone. Together, these units have a thickness of about 265 feet beneath the site. Shallow groundwater flow is expected to be to the northwest toward Shoal Creek. Most private water supply wells use the uppermost aquifer. The upper aquifer is separated from the lower aquifer by a confining unit composed of the Mississippian Northview Formation and Compton Limestone and the Devonian Chattanooga Shale. The lower aquifer includes Cambrian and Ordovician formations composed of sandstones and cherty dolomites. Water wells that require higher yields, such as community wells, must tap the deeper aquifer, which is hundreds of feet thick.

Public Drinking Water Advisory:

The nearest public water well to this site is over 1 mile south and serves a church. No impacts are expected.

Health Assessment:

The contaminants of concern at this site are heavy metals and cadmium. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Following the removal and cleanup of the site, cadmium levels exceeding the site soil action level were detected only in the concrete sampled from the walls and floors of the sludge storage vats. If the concrete does not stay intact, exposure to contaminants may occur via ingestion, inhalation, and dermal contact with contaminated dust.

In April 2001, the Missouri Department of Health and Senior Services sampled the on-site residential well less than 200 feet west of the former R&O Processors operations building; lead, cadmium, and zinc were detected. Only lead and cadmium levels exceeded EPA action limits of 15 parts per

billion for lead and 5 parts per billion for cadmium. Those detections are most likely due to the past electro-plating operations, but both cadmium and lead have been detected at elevated levels in other local groundwater samples and attributed to the historic mining in the area. The on-site well was tested again in August 2013; neither lead nor cadmium was detected.

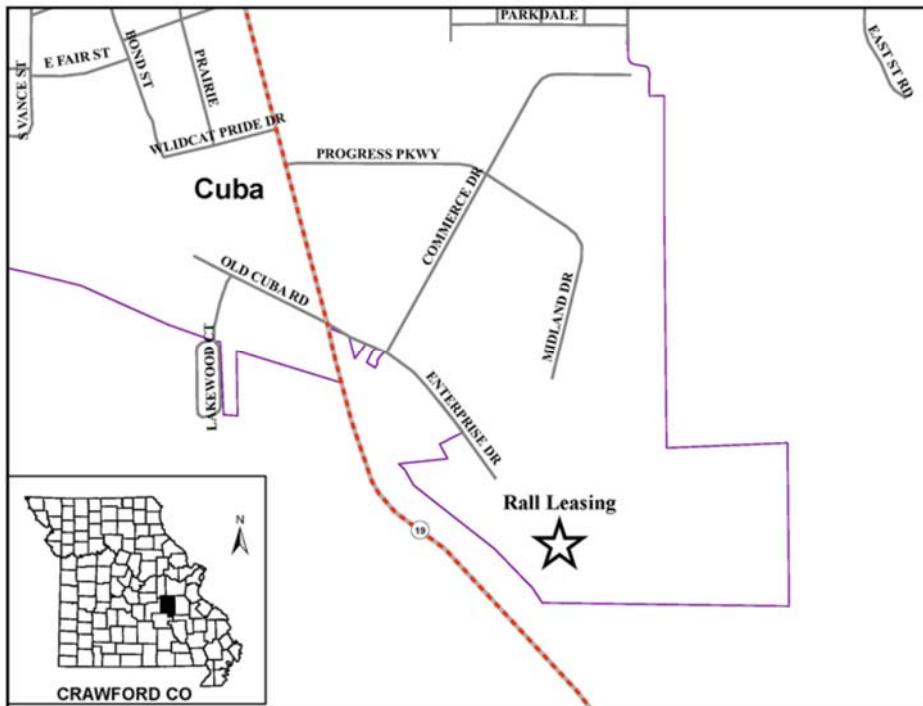
In 2003, the Missouri Department of Health and Senior Services sampled seven wells in this area for metals. Only lead was detected above the action level in one sample at 24 parts per billion. In 2005, they sampled four wells in this area. Lead and cadmium exceeded action levels in one of the well samples. In 2011 and 2015, four residents allowed their wells to be sampled; no contaminants were detected above established standards. In 2017, one private well was sampled, and only zinc was detected, but below established standards. In 2018, one private well was sampled for cyanide, which was not detected. The source of the lead and cadmium detections in the past private well sampling off site is unknown, but may be attributable to the historic mining in the area.

Because the on-site building contained old processing baths, the Missouri Department of Health and Senior Services made recommendations on safely removing this building from the site and cleaning up of the ground debris. Debris from the building is stored on the remaining building foundation.

Based on available information, this site does not appear to present a significant public health risk at this time. If conditions change such that levels of heavy metals in groundwater rise above health standards, individuals using private wells could experience adverse health effects. Although some homeowners refused sampling, the Missouri Department of Health and Senior Services recommends private well users continue to monitor their well water quality through annual testing.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Rall Leasing



Site Name: Rall Leasing

Classification: Class 3

Date of Registry Placement: July 25, 1995

Site Address: 200 Enterprise Drive, Cuba,
Crawford County, Mo.

Present Property Owner: Rall Leasing
Associates, a partnership

Lead Agency: Missouri Department of
Natural Resources

Waste Type: Trichloroethene (TCE)

Quantity: Not determined

Site Description: The 37-acre property located on the southern outskirts of Cuba, Mo. is mostly wooded, except for the warehouse building, and has one small lake. The main warehouse (124,000 sf.) was constructed in the 1950s, with additions in the 1960s and 1970s. Durban-Durco owned and operated the site as an automobile parts manufacturing facility in cooperation with B & K Manufacturing from 1970 to 1985. During this time, as part of the manufacturing process, a cleaning agent was used that contained TCE. Reportedly, the solvent was used until no longer effective and was then discarded onto

the ground outside the main warehouse. Specialty Polymer Services (SPS), Inc. leased the property and operated a plastic recycling facility on site since about 1994. SPS used the warehouse as a plastic storage facility. The facility was vacant by 2012 when contaminated soil was excavated.

Environmental Problems and Areas of Concern:

TCE contamination of soil discovered in 1990 and potential groundwater contamination were the initial concerns. The later discovery of abandoned drums, some containing chemicals, was added to the list of site issues.

Remedial Actions:

In 1990, soil samples collected from four borings on the west side of the main building had TCE levels up to 1,600 parts per million. A subsequent (1991) investigation by different contractors found a maximum level of 46.5 parts per million TCE in soil in the same area (this likely was due to variations in concentration in the soil, sampling techniques, or analytical methods, rather than actual changes in the site conditions). Groundwater samples were not collected during the 1990 or the 1991 sampling events. Based on the 1990 sampling, the Rall Leasing site was proposed for the Registry in 1992. The decision was

appealed due to ongoing litigation between the owners and former owners/operators. The appeal eventually was withdrawn, and the site was placed on the *Registry* in 1995.

After the Fiscal Year 2007 Registry annual inspection, the site was referred to the Department's Superfund Section for investigation of abandoned drums. The Department conducted a site reconnaissance for the pre-Comprehensive Environmental Response, Compensation, and Liability Information System Site Screening investigation November 2007. Department staff discovered approximately 196 drums containing a variety of chemicals including: waste terpinolene 3, butyl lactate, waste methyl methacrylate monomer, waste toxic solid (selenium and cadmium), waste paint related material, waste naphthalene, etc. The drums were located throughout the property in outbuildings as well as in the warehouse. Numerous drums were in poor condition and showed signs of possible leaking. The SPS plant manager reported that the drums did not belong to SPS, but had been left by previous tenants of the property.

In fall 2007, Rall Leasing contracted to characterize and dispose of the drums. All drums outside the warehouse were taken to Solvent Recovery Corporation for disposal.

In March 2008, the site was enrolled in the Department's Brownfields/Voluntary Cleanup Program to clean up the TCE contamination and to ultimately get Rall Leasing removed from the *Registry*. In December 2008, the Department approved a remedial action plan for soil removal and groundwater monitoring. Seventy cubic yards of TCE-contaminated soil was removed from the area originally identified in 1990, to a depth of about 5 feet. Floor and wall samples were collected, and some residual TCE concentrations remained. Four monitoring wells were installed to the top of bedrock around the excavated area. During six monitoring events, the wells consistently were dry, except for one well during one sampling event. The Department did not receive a final report on the site activities at that time, and sent a letter stating that if the report of work conducted was not submitted by December 8, 2011, the site would be terminated from the Brownfields/Voluntary Cleanup Program. On December 9, 2011, a partial report was received. The Department then requested a complete report by

November 19, 2012. No report or correspondence was received; therefore, the site's participation in the Brownfields/Voluntary Cleanup Program was terminated on November 27, 2012.

The owners re-applied to, and were re-activated within, the Brownfields/Voluntary Cleanup Program in 2017. An updated Phase I Environmental Site Assessment report was submitted along with a complete remediation and risk assessment report originally drafted in 2012 and updated in 2017. The report concluded that remediation was successful, and that soil and groundwater investigations show that residual contamination at the site does not pose any unacceptable risks to human health or the environment.

Residual TCE found in wall and floor samples was deemed insignificant with respect to vapor intrusion exposure. Soil samples collected down to the bedrock surface in and around the previous excavation did not find contamination migrating downward, and the shallow wells did not encounter significant groundwater. Therefore, no further investigation of groundwater was deemed necessary. The majority of the abandoned drums removed previously reportedly were empty, and those with contents were stored on concrete paved areas prior to removal. Department staff toured the site June 2018. The site remained vacant, and no debris, drums, waste, staining, or stressed vegetation was observed. The Department determined that all environmental issues at the site were addressed adequately, and issued a certification of completion on September 21, 2018, with no restrictions imposed on the site or its future uses.

General Geologic and Hydrologic Setting:

The Rall Leasing site is located on a high ridgeline extending from a broad upland area at the south edge of the city of Cuba. The land surface is nearly flat, but moderate to steep slopes exist within a short distance to the east and west, where headwater streams of the Meramec River meet the edge of the upland area. Surface water runoff drains either west to Pine Branch or east to a tributary of Lick Creek; both are tributaries of the Meramec River.

Boring logs obtained during site investigations

indicate that depth to bedrock varies from 4.5 to 19 feet below the surface. The near-surface bedrock is undifferentiated Pennsylvanian-age sandstones, siltstones, shales, and sand- to boulder-size carbonate pieces. Typically, the unit effectively restricts downward migration of water. The thickness, composition, and elevation of this unit may vary considerably over short lateral distances. Drilling records of wells near the site indicate the thickness of the Pennsylvanian deposits varies from 40 to 70 feet. Ordovician-age cherty dolomite and sandstone bedrock is present beneath the Pennsylvanian bedrock. These Ordovician bedrock units compose the Ozark Aquifer.

Most private drinking water wells in the area are open to the Ozark Aquifer. The water table elevation within this aquifer lies about 200 feet below the surface of the site. Groundwater is anticipated to move in a southerly direction toward the Meramec River. Perched groundwater may exist in the uppermost bedrock or in overlying surficial materials.

Public Drinking Water Advisory:

The city of Cuba draws water from the Ozark Aquifer from a series of deep-rock wells. The closest of these wells, constructed in 2012, is approximately 0.1 miles north of the site and is cased 500 feet deep. The city's other wells are all located at least one mile away from the site to the north. The proximity of the closest well to the site is notable, but site-related contamination has not been detected.

Health Assessment:

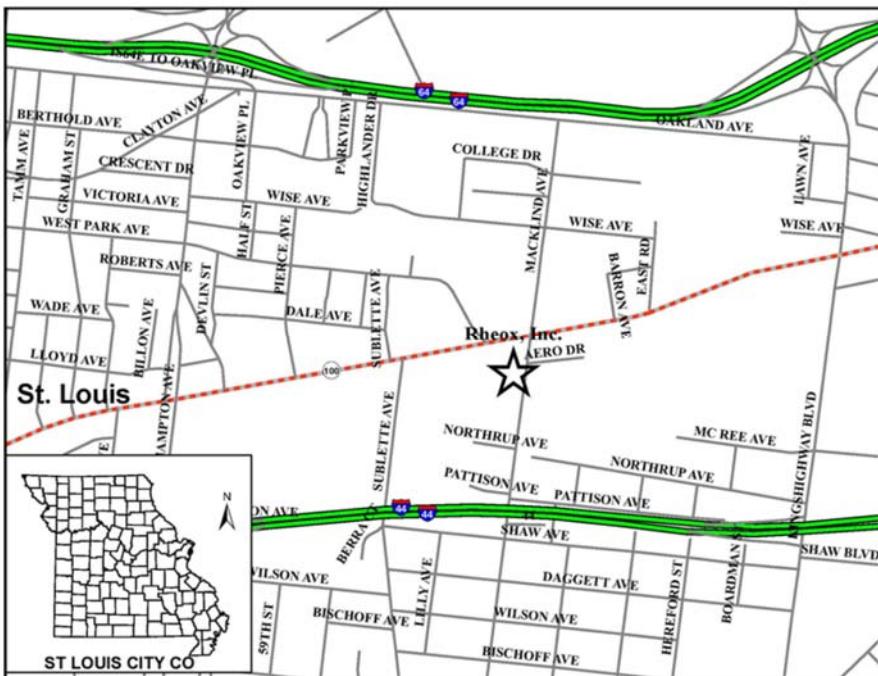
The chemical of concern in soil is TCE. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

Due to TCE's migration potential, Missouri Department of Health and Senior Services collected samples from off-site private wells in 2005, 2006, and 2007. No volatile organic compounds or TCE were detected in any of the samples.

Based on the Missouri Department of Health and Senior Services water testing and Brownfields/Voluntary Cleanup Program analysis, this site does not appear to present a significant health risk to the public at this time.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Rheox, Inc.



Site Name: Rheox, Inc.

Classification: Class 4

Date of Registry Placement: April 14, 1992

Site Address: 5548 Manchester Ave., St. Louis, Mo

Present Owners: Elementis Specialties

Lead Agency: Missouri Department of Natural Resources

Waste Type: Lead

Quantity: Not determined

Site Description: The Rheox Site is located in an 8.33-acre industrial and commercial area at the southwest corner of the intersection of Macklind and Manchester Aves. Bordered by railroad tracks to the north and south, it is a roughly rectangular parcel of flat land. The nearest residence is 500 feet northeast of the site. Several public parks are located within a 3-mile radius. The entire site is fenced to restrict access, and a security guard is on site.

National Lead (NL Industries) operated a white lead manufacturing facility at the property beginning in the late 19th century providing white pigment for paint and other

products. Lead-based pigment production ceased at the site around the time of World War II, when the company transitioned to producing lead sulphate and chromate products and rheological agents. Lead chromate production was discontinued at the site in 1990. National Lead split off a division of the company as Rheox Inc., which was then acquired by Elementis Specialties in 2000. Currently, the Elementis facility manufactures various surface coating products.

Due to past manufacturing processes, high concentrations of lead are present in on-site soil. Soil sampling conducted by an NL Industries consultant has documented lead levels in the soil at concentrations over 20,000 parts per million. A Rheox consultant collected and analyzed soil from the site in 1990 using the toxicity characteristic leaching procedure (then known as the EP Tox test) and documented leachable concentrations of lead in soil as high as 168 parts per million, which characterizes the soil as hazardous waste under the Resource Conservation and Recovery Act.

Environmental Problems and Areas of Concern:

High levels of lead are present in soil at the site. Areas of high lead contamination have

been capped with asphalt and concrete, and the entire parcel is covered with impermeable surfaces. Lead contamination is not expected to pose a risk at the site as long as these surfaces are maintained. Disturbance or deterioration of the cap or removal/modification of buildings could cause direct exposure to lead contamination and result in migration of lead off site via surface runoff.

Remedial Actions:

During fall 1992, Rheox installed a cap consisting of a layer of asphalt over an impermeable geofabric liner. The cap was placed across the eastern third of the parcel where no buildings are located. No additional remedial actions have been conducted at the site.

The Department has approved several change of use requests at the site to allow for subsurface utility work and property improvements. Previous annual inspections have noted minor cracking in some of the paved and capped areas at the site, although they are not considered significant enough to warrant repair. The Department inspector noted nothing of significance at the Rheox, Inc. site during the most recent inspection, completed on May 24, 2018.

General Geologic and Hydrologic Settings:

The Rheox facility is situated in an industrial corridor next to River des Peres, a Mississippi River tributary. As the city grew, the river channel was straightened and the riverbed paved. It is now the main channel for the St. Louis City storm sewer system.

Railroad tracks separate the Rheox Site from the concrete banks of River des Peres. The site is level with only 4 feet of total surface relief. Surface runoff flows into the river or into storm sewer inlets that feed the river.

Lead contamination at the Rheox Site is likely concentrated in fill material, which averages 6 feet thick across the site. The underlying natural soils are clay-rich, with moderate to low permeability. Perched water is present commonly at the fill-soil interface.

Although site-specific boring information is not available, bedrock is expected to be the Pennsylvanian-age Cheltenham Formation. The Cheltenham Formation is made up of

consolidated clays with thin, interbedded coal beds. Clay and coal were mined from most of the area surrounding the site. Open or water-filled mine cavities may still be present under portions of the Rheox facility. Mine deterioration has created several collapse features just south of the site, and engineering problems associated with mining still exist today. Groundwater recharge to the bedrock is limited. Under present site conditions, groundwater supplies do not appear to be threatened by lead contamination.

Groundwater from bedrock aquifers in St. Louis City is generally high in dissolved solids, and no known water wells are in the vicinity of the site.

The main concern is the potential for direct exposure to the contaminated material or off-site migration of lead contaminants via surface water runoff. Mobilized lead or lead-contaminated soil particles entering River des Peres may be deposited in sediment traps downstream, or may eventually reach the Mississippi River, about 8 miles downstream of the site.

Public Drinking Water Advisory:

The City of St. Louis obtains water from the Missouri and Mississippi rivers. No impacts to public water supplies are expected.

Health Assessment:

Lead is the primary contaminant of concern at the site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

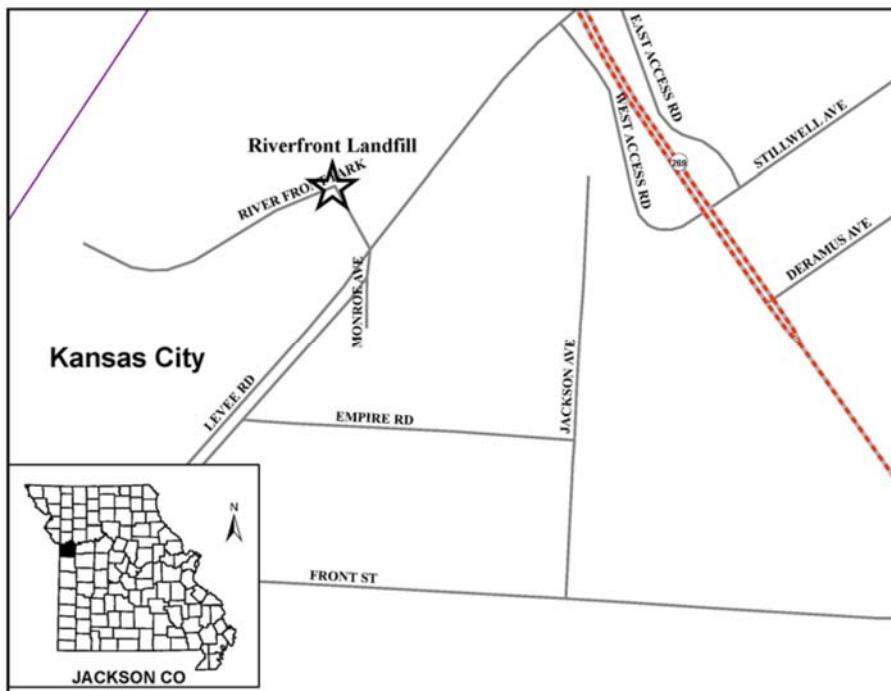
Lead contamination at the site is located in the subsurface and is covered by asphalt, concrete, and building structures, which eliminate direct contact with the contamination. Groundwater is not used for drinking, as the area is served by a public water system obtaining water from the Mississippi and Missouri Rivers.

There are currently no complete exposure pathways. This site is fenced and gated to restrict public access. Based on the available information, this site does not appear to present a significant public health risk at this time. This could change if excavation were to occur or if the asphalt cap were allowed to

deteriorate.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Riverfront Landfill



Site Name: Riverfront Landfill

Classification: Class 4

Date of Registry Placement: January 14, 1984

Site Address: Levee Road at Chouteau along the south bank of the Missouri River from River Mile 363.5 to 359.0, Kansas City, Jackson County, Missouri, NW 1/4, Sec. 27; SE 1/4, Sec. 22; N 1/2, Sec. 17; N 1/2, Sec. 16; SW 1/4, NW 1/4, NE 1/4, and SW 1/4, Sec. 15, T. 50N, R. 33W, North Kansas City Quadrangle

Present Property Owner: City of Kansas City

Lead Agency: EPA

Waste Type: Metals, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs)

Quantity: Not determined

Site Description:

The Riverfront Landfill site is located on the south bank flood plain of the Missouri River in Kansas City, Missouri, and extends southward to the U.S. Army Corps of Engineers' East

Bottoms Levee. This levee is placed approximately 1,000 feet back from the riverbank and runs the entire length of the site. The site extends eastward from a point about 4,000 feet southwest of the Chouteau Trafficway Bridge, to a drainage swale adjacent to the Harry S Truman Bridge. The site is approximately 1,000 feet wide by 3.5 miles long and covers an area of approximately 420 acres.

For descriptive purposes during past studies, the site was divided into three areas. Area I lies to the west of the Chouteau Bridge, Area II is located between the Chouteau and I-435 bridges, and Area III lies to the east of the I-435 Bridge.

U.S. Army Corps of Engineers completed construction of the East Bottoms Levee in 1950. From 1950 to 1972, the Kansas City Public Works Department operated the site as a landfill for domestic and industrial waste disposal. By the late 1960s or early 1970s, the Kansas City Public Works Department moved operations entirely into Area III between the I-435 Bridge and the Harry S Truman Bridge.

In June 1981, the city of Kansas City notified EPA that the site might contain hazardous wastes. In response to this notification, EPA conducted a preliminary site investigation, which was completed in 1982. In 1983 and

1984, EPA performed additional studies which resulted in a recommendation to close the site, including the developed public areas. In November 1985, the Kansas City Parks and Recreation Department closed the Riverfront site. In June 1987, EPA and the city of Kansas City signed an administrative order on consent to conduct a response investigation. From 1987 to 2004, the city of Kansas City conducted several studies to assess the levels of on-site contamination.

Environmental Problems and Areas of Concern:

As was common practice in solid waste disposal during the 1950-1972 period, the landfill operated without liners, leachate controls, or multilayer final covers. Burning, in combination with land disposal, was the customary practice. Solid wastes were placed in shallow trenches or pits and often were burned and eventually covered with available soil. Liquids were treated in a similar manner. Burning of liquid wastes, specifically polychlorinated dibenzofurans, may have resulted in polychlorinated biphenyls, which are environmentally persistent. Most cover soils were composed of silt and sand.

Until 1963, waste disposed at the site was unregulated, and records were inadequately kept. From 1963 to 1968, documentation shows that the landfill accepted a variety of waste, including: domestic, construction, demolition, non-infectious hospital, power plant, general chemical, paint sludge, polishing solvents, and electroplating wastes. When open burning and backyard incinerations were prohibited in 1968, an estimated 150,000 domestic burn barrels had been disposed at the site. After 1968, only domestic wastes and demolition debris were accepted.

Groundwater controlled the depth of excavation. Past studies have indicated that most trenches were 6 to 7 feet deep, although some trenches have been reported to be as deep as 15 feet. The Missouri River alluvium and depth to groundwater is 7 feet. Since the site was excavated to the water table and filled without the benefit of a liner, infiltrating materials are likely to contaminate groundwater. Groundwater is used locally for industrial processes. Surface runoff is toward the Missouri River. At one time, final cover material eroded, which exposed solid wastes

and allowed them to enter the Missouri River, but release of hazardous waste apparently was not involved. The city of Kansas City corrected the problem by repairing the cap.

Remedial Actions:

In August 1982, EPA collected surface and subsurface soil samples to establish the types and levels of chemical contaminants. Inorganic metals were found at higher levels than the expected range in alluvial soils. VOCs were found above detection limits. Polychlorinated biphenyls were detected at levels well below the 50 parts per million Toxic Substances Control Act standards for old disposal sites. EPA installed shallow groundwater monitoring wells to investigate potential groundwater contamination. In 1984, the city of Kansas City collected samples that indicated on-site soil concentrations of lead from 49 to 8,000 parts per million.

In July 1987, the city of Kansas City was issued an administrative order on consent by EPA under Section 3013 of the Resource Conservation and Recovery Act and Section 106 of the Comprehensive Environmental Response, Compensation, and Liability Act. The city of Kansas City was required under the order to conduct groundwater monitoring, keep the site closed to the public, and clean up or cap lead-contaminated soil once the groundwater monitoring had been complete.

The city of Kansas City sampled groundwater at 18 monitoring wells in January and April 1988. Arsenic, barium, chromium, lead, benzene, and vinyl chloride were detected in groundwater at concentrations above EPA's drinking water standards, the maximum contaminant levels. In February 1990, the city of Kansas City submitted a final Groundwater Investigation report for Riverfront Landfill with a groundwater risk assessment. The risk assessment concluded that, under current conditions, exposure to on-site groundwater and surface water contaminants presented no unacceptable risks to human health and the environment.

The principle concern at the site is the potential for direct human contact with contaminated surface soils. Investigations of Area I documented elevated lead levels in soil. The Missouri Department of Health and Senior Services agreed that the city of Kansas City's plan to cap areas of Riverfront Landfill

with lead concentrations above 500 parts per million would be protective of human health and the environment, provided the site remains on the *Registry*. In 1992, the city of Kansas City capped selected portions of Area I. The city of Kansas City also installed a chain link fence on the west side of Area II, the east side of Area III, and south of the levee along both Area II and Area III. The flood of 1993 damaged the fence in some areas and impacted the cap. The city of Kansas City repaired both the fence and cap.

In 1995, the EPA sent a "no further action letter" to the city of Kansas City with respect to lead leaching into the groundwater. The city of Kansas City continues to monitor on-site groundwater. The city of Kansas City enrolled the site in the Department's Brownfields/Voluntary Cleanup Program, but withdrew it in 1999 with no progress made toward site characterization.

The Department approved installation of a storm water drainage sewer through the landfill in 1999 and the installation of a storm water pumping station in 2000. In 2001, the city of Kansas City submitted a change of use request for maintenance on an outfall pump, including removal of silt and brush from a ditch near the outfall pump. The Department approved the change. In 2003, the city of Kansas City received approval from the Department to refurbish and reopen the boat ramp in Riverfront Park, which provides access to the Missouri River.

In 2004, the city of Kansas City conducted an additional investigation in Area I of Riverfront Park to evaluate the acceptability of current conditions with respect to the park's limited use during the June-July 2004 Lewis and Clark celebration. The investigation included collection of surface soil samples for lead analysis and surveying the surface and subsurface for methane. The Department and the Missouri Department of Health and Senior Services agreed that the results of the surface soil lead sampling would be compared to Cleanup Levels for Missouri Soil Target Concentration for lead under Scenario A (residential use) of 260 parts per million. With the exception of one sample, none of the concentrations of lead detected in the surface soil samples exceeded the action level of 260 parts per million in the 2004 sampling event. Lead was detected at 320 parts per million in the sample located in the park area's

southwest corner, in a wooded area south of the access road to the boat ramp. There is no vehicle access to this area and it would not be suitable for camping. Levels of methane detected in all samples from all aspects of the investigation were well below applicable guidelines.

The state has been working with the city of Kansas City to develop the site for recreational Green Space and to develop a master plan for future use. All areas of the site have been characterized. No compounds were found at levels that would prohibit recreational use.

General Geologic and Hydrologic Setting:

The site is on the Missouri River flood plain. Soil texture may range from clay to sand, but for the most part, the soils are made up of predominantly coarse material with moderate to high permeability.

The site sits directly atop the Missouri River alluvium, which is an important groundwater source for the area. The alluvium is underlain by the Pennsylvanian-age Kansas City Group, which is composed of interbedded limestones and shales with low to moderate permeability. The alluvium is recharged through surface infiltration from rainfall and runoff from adjacent areas, as well as from the river during high stages. Some recharge may also be received from surrounding and underlying bedrock. In February 1990, the city of Kansas City submitted a final Groundwater Investigation report for Riverfront Landfill. Groundwater contour maps indicate that, under normal flow conditions, groundwater flow is toward or parallel to the river. Under abnormally high flow conditions, groundwater flow may be away from the river.

Public Drinking Water Advisory:

No public water sources are located near this site. The City of Independence's well field is approximately 4 miles downstream of the site and draws from the Missouri River alluvium, but no site-related impacts are expected.

Health Assessment:

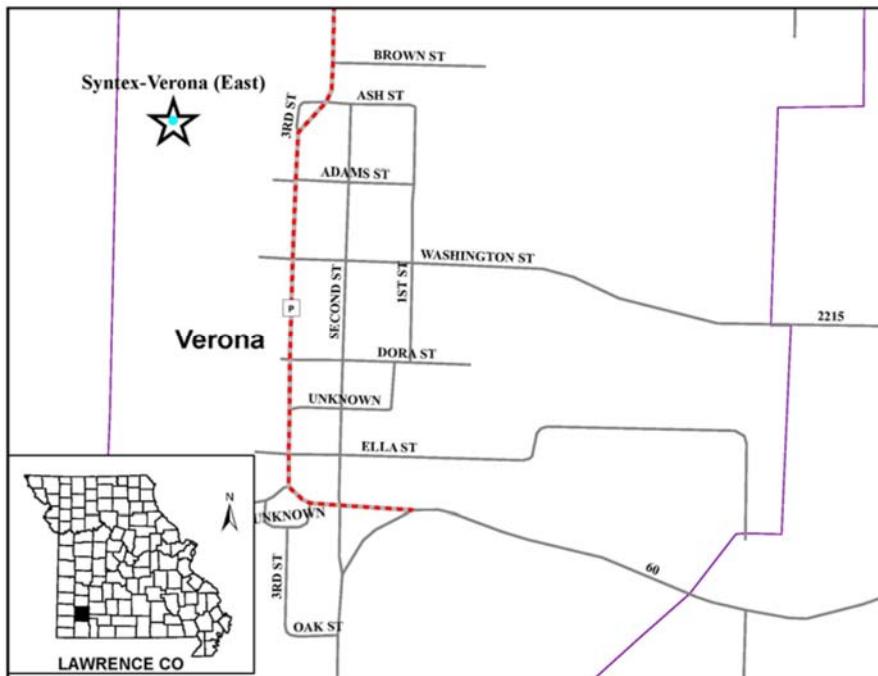
The contaminants of concern at this site are: benzene, beryllium, bromodichloromethane, chlorobenzene, chloroform, chromium, 1,2-dichlorobenzene, 1,3-dichlorobenzene,

1,4-dichlorobenzene, 1,1-dichloroethane, 1,2-dichloroethene, ethylbenzene, lead, mercury, selenium, 1,1,2,2-tetrachloroethane, toluene, 1,1,2-trichloroethane, trichloroethene, and vinyl chloride. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Currently, no health risk is expected since exposure is not occurring. If site conditions change such that exposure to contaminated soils is possible, adverse health effects could result.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Syntex - Verona (East)



Site Name: Syntex - Verona (East)

Classification: Class 4

Date of Registry Placement: January 1, 1984

Date of NPL Listing: September 8, 1983

Site Address: 299 Extension Street, Verona, Lawrence County, Mo

Present Property Owner: BCP Ingredients, Inc.

Lead Agency: EPA

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

Quantity: Not determined

Site Description:

The Syntex - Verona (East) site is an active manufacturing facility located in Verona, Missouri, east of the Spring River. The site is part of the larger Syntex Facility Superfund Site (Site) listed on EPA's National Priorities List. The Syntex - Verona (East) site is where Northeastern Pharmaceutical and Chemical Company formerly leased a building to manufacture hexachlorophene and produced

TCDD as an unwanted byproduct. This property includes a manufacturing facility and surrounding open space east of the Spring River, and is currently owned by BCP Ingredients, Inc.

The Syntex - Verona (East) site contains five distinct areas of surface or near-surface soil historically contaminated with TCDD. These were remediated by Syntex with EPA oversight. In September 1998, EPA provided a completion letter for the soils portion of the site. There is no public access, and the site is restricted to industrial land use. In 2002, at the request of the property owners, the Syntex Facility Superfund Site was divided into two separate sites for purposes of the Missouri Registry: The Syntex - Verona (East) site and the Syntex - Verona (West) site. The Syntex - Verona (West) site is owned by Syntex Agribusiness, Inc. (Syntex) and is west of the Spring River. For remediation and regulatory purposes, the two properties are still treated as one site.

Environmental Problems and Areas of Concern:

With EPA oversight, numerous investigations at and around the site were conducted to delineate the nature and extent of chemicals of concern. The compound TCDD was identified to be the primary chemical of

concern in soil necessitating remediation.

Analyses of fish taken from the river in 1981 showed TCDD levels that exceeded the U.S. Food and Drug Administration recommendations for fish consumption. In 1982, the Missouri Department of Health and Senior Services issued a fish-consumption advisory for fish caught on the river. Subsequent fish samples showed that TCDD levels had declined and the Missouri Department of Health and Senior Services removed the fish advisory in 1993, stating that all species of fish anywhere in the Spring River may be consumed in unlimited amounts.

Syntex conducts ongoing groundwater and soil sampling activities with EPA and the Missouri Department of Natural Resources oversight. These monitoring activities show there are no unacceptable risks to industrial workers or short-term contract workers at the site.

Remedial Actions:

Syntex conducted on-site remedial actions under EPA oversight in accordance with the 1988 Record of Decision. The actions included excavation of TCDD-contaminated soils, decontamination and disposal of TCDD-contaminated equipment, off-site thermal treatment of excavated soils and cleaning solutions, and establishment and maintenance of vegetative soil covers over areas exceeding TCDD threshold levels.

A process was designed to destroy TCDD in waste material left by the Northeastern Pharmaceutical and Chemical Company. This waste material was treated, and the fluids from the treatment were incinerated at EPA's mobile incinerator. Ultimately, all contaminated equipment was decontaminated, and related wastes also were incinerated at the mobile incinerator. The site's remediated areas do not contain levels of TCDD greater than 20 parts per billion based on the EPA-approved Facility Implementation Plan and standard sampling methodologies.

In August 1996, Syntex sold the manufacturing plant and surrounding property east of the Spring River to DuCoa. DuCoa sold the site to BCP Ingredients Inc. in 2001. Syntex remains responsible for the continued

investigation and monitoring of the site.

In September 2017, EPA completed the fifth Five-Year Review Report and noted that based on available data, protectiveness of the remedies for soil and groundwater could not be determined. The report recommended that the ongoing investigation continue for both soil and groundwater for the entire site. The Department completed its Fiscal Year 2018 annual Registry inspection on April 10, 2018. The inspection report noted nothing of significance. Vegetative soil caps remain in satisfactory condition and the site is highly maintained.

General Geologic and Hydrologic Setting:

The site is located on the Spring River flood plain, which contains numerous abandoned meanders. The meanders consist of gravelly materials, having a higher permeability than the surrounding materials. A portion of the site sits atop an abandoned channel that was filled prior to plant construction.

Two bedrock aquifers are present at the site: the shallow Mississippian limestone aquifer called the Springfield Plateau Aquifer, and a deeper aquifer made up of Cambrian- and Ordovician-age carbonates and sandstones called the Ozark Aquifer.

The Springfield Plateau Aquifer is made up of cherty limestones that directly underlie the alluvium. This aquifer supplies limited yields to shallow wells and is subject to contamination from local sources, such as septic tanks and agricultural runoff, either through permeable soil and bedrock or through poorly-cased wells. At this site, the alluvial materials and the Mississippian bedrock are connected hydraulically. Shallow groundwater flow is generally north-northwest towards the Spring River.

The Ozark Aquifer, present typically at depths greater than 300 to 400 feet, is used to supply major industrial and municipal users and individual landowners in the area. In general, the Ozark Aquifer in this region of the state has not been affected greatly by surface contamination; however, some localized pollution has resulted because of poorly-cased deep wells penetrating both the upper and lower aquifers.

Public Drinking Water Advisory:

The closest public water well to this site lies about 0.5 miles east of the City of Verona and serves a small subdivision. The well is cased 360 feet, draws from the deep Ozark aquifer, and site-related impacts are unlikely. The combined Aurora-Verona public water system also uses deep wells to draw water from the Ozark aquifer, but the closest well to this site is over 2 miles east-northeast from this site. No impacts are expected.

Health Assessment:

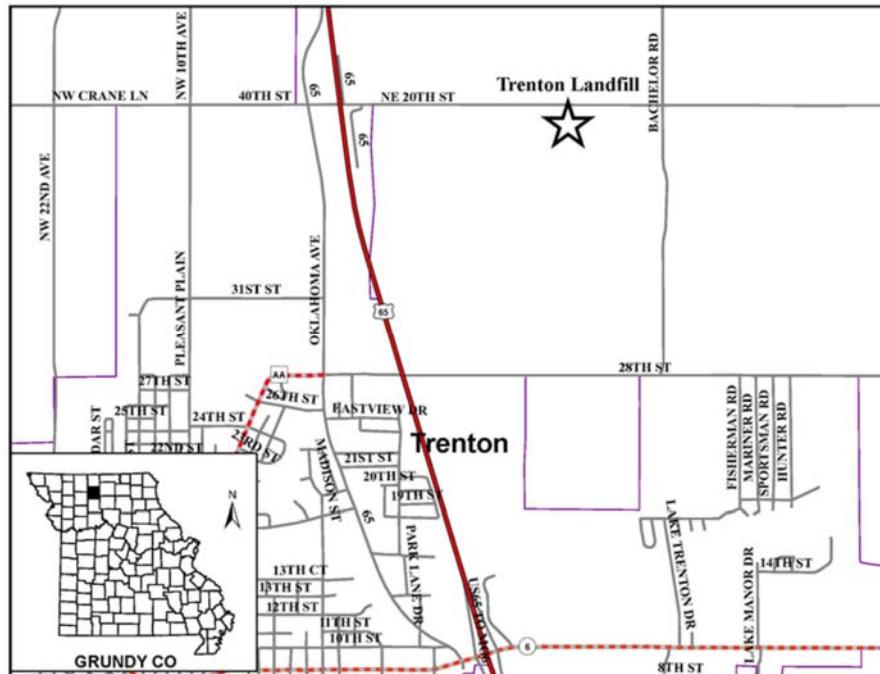
TCDD is the chemical of concern at this site. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with this contaminant.

Potential routes of exposure include direct exposure to the contaminated soil or inhalation of contaminated dust. Access to the site over land is limited, but the site is potentially accessible via the Spring River. Fish taken from the Spring River are now considered safe to eat, because sampling has shown that TCDD levels are no longer of health concern.

Based on available information, it cannot be determined whether a threat to public health exists. Remedial activities approved by EPA were implemented to mitigate potential site risks. The continued site investigation and reassessment discussed in the fifth Five-Year Review will more accurately determine remaining site risk, and whether additional remedial action is necessary for the site remedy to be protective of human health and the environment.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Trenton Landfill



Site Name: Trenton Landfill

Classification: Class 4

Date of Registry Placement: June 10, 1992

Site Address: Northeast of the city of Trenton, east of Highway 65 in Grundy County, Missouri, NE 1/4, NW 1/4, Sec. 10, T. 61N, R. 24W, Trenton Quadrangle

Present Property Owner: Connie S. Gwinnup and Anthony Clifford Droz

Lead Agency: Missouri Department of Natural Resources

Waste Type: Heavy metals, paint waste, and herbicides

Quantity: Not determined

Site Description:

The city of Trenton used this 40-acre site as a pre-law landfill from 1959 until 1975 when it received a Solid Waste Sanitary Landfill Permit, #107901. The landfill ceased accepting waste in 1979. In 1985, elevated levels of heavy metals were documented in Muddy Creek, downstream from the landfill. This discovery prompted the Department to investigate the landfill as a potential

contamination source. These investigations determined that a large quantity of hazardous waste had been disposed of during the landfill's operation. These wastes included chromic acid sludge, paint waste, and herbicides. Today, the property appears as an open field but the waste mass remains buried on site. As part of the site's stabilization, it was planted with native grasses, trees, and forbs. The property is located in a predominantly rural agricultural area. The property is now privately owned and inspected regularly by the Department.

Environmental Problems and Areas of Concern:

In the past, sediment samples indicated that hazardous substances from the landfill impacted Muddy Creek. The site has potential for off-site migration of waste constituents via shallow groundwater. Cap erosion and leachate outbreaks have been a concern in the past.

Remedial Actions:

The site has had a history of erosion, resulting in exposed solid waste, hazardous substances, and hazardous waste; subsidence of the cap that caused ponding; and leachate outbreaks, potentially entering Muddy Creek. The responsible parties have

performed stabilization and repair work to address these issues.

The most recent repair work, including work needed to fix areas where all-terrain vehicles had damaged the landfill cap, was completed in 2015. To address the damaged areas, the existing berms were pushed over into the areas of subsidence, and the existing soil was spread and compacted. Off-site soil was added to create a clay cap that was 3 feet thick with enough top soil added to support good vegetation. Woody vegetation was removed, but trees on the western edge were left intact to protect the stream bank and to uptake subsurface leachate. The site was graded, seeded, and mowed.

On October 19, 2015, the Department conducted a closed sanitary landfill inspection. The Department observed a few areas of dead vegetation in the southwest and northeast corners as well as along the eastern boundary. Additionally, staff observed a few pieces of litter scattered throughout the landfill that were exposed from the recent mowing. ATV tracks/damage observed during the previous 2014 inspection had been repaired, and no evidence of continued ATV use was observed. Additionally, no evidence of ponding of water was observed on the landfill.

The site is fenced along the east and south side but is open along the Muddy Creek to the west and along the road to the north. Following a 2014 inspection, the site had posted some additional "No Trespass" signs and the Sheriff's Office began patrolling the area more regularly. On May 9, 2017, the Department conducted a closed sanitary inspection and the landfill was found to be in compliance based upon observations made at the time of the inspection.

General Geologic and Hydrologic Setting:

The Trenton Landfill is located in the Dissected Till Plains physiographic region of northern Missouri. The site is located on the western slope of a rolling upland adjoining Muddy Creek, which flows along the site's western boundary.

Much of Grundy County is covered by glacial drift, a heterogeneous, unconsolidated deposit of clay, sand, gravel, and boulders. Some of the sands in the lower layers of the till form permeable beds of limited lateral and vertical

extent. These lenses are a source of poor-quality drinking water for several wells within 2 miles. The till underlying the site is expected to be more than 100 to 150 feet thick. Flow of any groundwater existing in the sand lenses of the lower till likely is to the southeast.

The fine-grained, low permeability sediments beneath the site should retard the downward movement of surface water and leachate, reducing impacts to groundwater. However, if sand lenses are present in the till, contaminant movement and migration within groundwater will be enhanced.

Bedrock beneath the landfill is probably shale and sandstone of the Cherokee Group, which is about 435 feet thick at Trenton. Minor amounts of clay, coal and limestone also occur in the Cherokee Group. In fact, an undulatory bed of coal was mined at the Trenton Mine, 1 mile southeast of the landfill. In general, the large shale content of most Cherokee strata greatly impedes the flow of groundwater. The basal member of the Cherokee Group is a water-bearing sandstone more than 100 feet thick; in southeast Grundy County, water from this layer is suitable for livestock. However, the bedrock aquifer's low yields and high dissolved-solids content make it unsuitable for most uses.

Public Drinking Water Advisory:

Trenton Municipal Utilities uses the Thompson River as a primary water source, and no site-related impacts are expected. Groundwater in the region is generally of poor quality, so shallow aquifer contamination is not a significant threat to the public.

Health Assessment:

Landfill records indicated that numerous chemicals associated with waste oils, wastewater treatment sludge, heavy metal sludge, paint sludge, solvents, and acid cleaning solutions may be present in the landfill. High concentrations of metals were at one time identified in Muddy Creek. The current chemical composition and concentration of chemicals and metals in the landfill soils, landfill runoff, and water and sediment of Muddy Creek are unknown.

Potential human exposures to site-related contamination may result from contact with surface water runoff, leachate, shallow

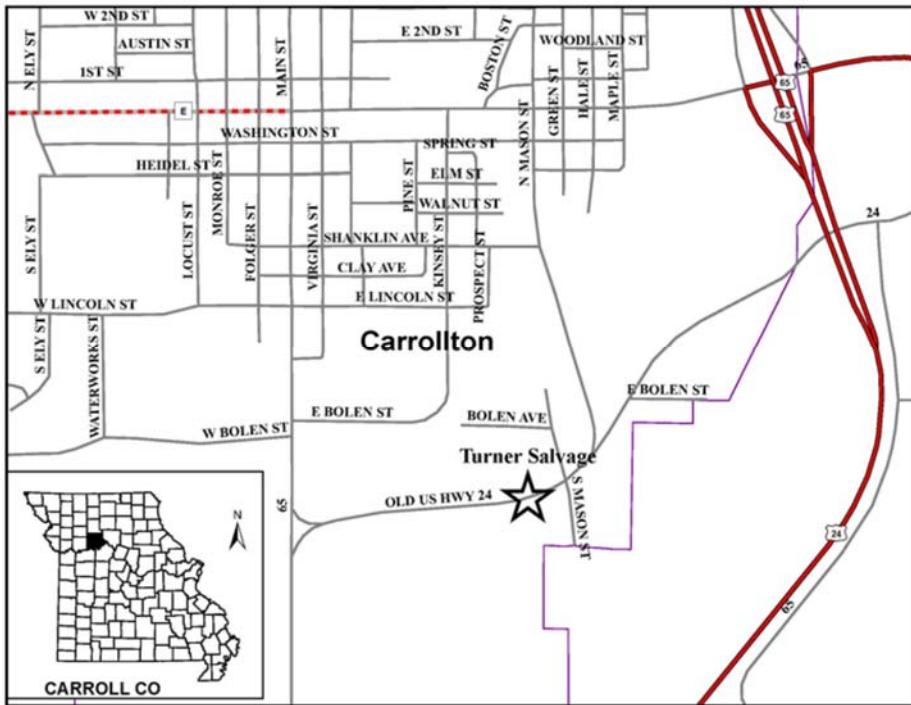
groundwater, and surface water. Now that the site has a three-foot-thick clay cap, potential human exposures to site-related contamination via exposed debris and subsurface and surface soils should be very limited. Persons directly exposed to site-related contaminants may include trespassers and maintenance workers. Potential exposure to leachate within water and sediment of the Muddy Creek includes recreational use and irrigation. The ephemeral nature of Muddy Creek may expose persons involved in recreational activities including swimming, wading, and fishing. Wildlife, livestock, and fish may become contaminated due to exposure to contaminated surface water adjacent to and downstream of the site. Heavy metals bioaccumulation in the aquatic food chain could contaminate fish, thus a potential exposure pathway exists via local fish consumption.

Exposure to contaminated groundwater used as a potable water source is not likely. Based upon geologic and hydrologic investigations, downward movement of contaminants is unlikely. The Missouri Department of Health and Senior Services did not find any private wells within 1 mile of the site.

Based on available information, direct exposure to this site does not appear to pose a significant health threat to the public at this time. Exposure to site-related contamination may occur through direct contact to leachate at the site and in Muddy Creek. Exposure is being minimized by increased maintenance of the site's soil cap and groundcover, fencing along the east and south side, posting additional "No Trespass" signs, and having the Sheriff's Office began patrolling the area more regularly in effort to keep trespassers out. Current risk or exposures to Muddy Creek sediment and fish is unknown. Testing water and sediment for site-related contamination may still be needed.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Turner Salvage



Site Name: Turner Salvage (formerly Tonnar Salvage)

Classification: Class 4

Date of Registry Placement: May 16, 1997

Site Address: 306 Business Hwy 24 East, Carrollton, Carroll County, Mo

Present Property Owners: Advantage Metals Recycling, LLC

Lead Agency: EPA

Waste Type: Ignitable materials, volatile organic compounds (toluene, ethylbenzene, xylenes, 2-butanone, and benzene), trichloroethene (TCE), metals (chromium, lead and beryllium), polychlorinated biphenyl-containing transformers, and asbestos-containing materials

Quantity: Not determined

Site Description:

The site, now closed, was operated as a salvage yard until approximately October 2008. The site is located in a commercial and residential area on the southeastern boundary of the city of Carrollton.

Environmental Problems and Areas of Concern:

The site is within the Missouri River's 10-year flood plain. Shallow groundwater below the site and sediments immediately downstream are contaminated with lead.

Residual soil contamination remains at several locations. The area is bounded on the south and east by Standley Branch Creek, which discharges into Wakenda Creek 0.25 mile from the site. Wetlands are associated with both waterways.

Remedial Actions:

The Missouri Department of Natural Resources concluded that the site should be listed on Comprehensive Environmental Response, Compensation, and Liability Information System based on a site screening in August 1996. The Department requested that EPA evaluate the site for a time-critical removal action. EPA completed a removal assessment in December 1996.

EPA conducted an additional site investigation and sampling in January 1997. EPA and Turner Salvage entered into an Administrative Order on Consent for removal action in November 1997. In April 1998, EPA approved

Turner Salvage's work plans for the removal action.

In December 1998, Turner Salvage conducted a Superfund removal action. Turner Salvage containerized hazardous wastes, used oil, and lead-based paint and disposed of the material off-site.

Isolated areas of contaminated soils were excavated by Turner Salvage. The resulting wastes were characterized and transported for disposal as nonhazardous wastes. The nonhazardous wastes included the oil spill area south of the Turner Salvage Garage on the south side of the highway; lead-contaminated soil near the burned barn; TCE-contaminated soil south of Building C; and oil-contaminated soil near the metal compactor and baler. However, some areas of potential concern remain: the oil spill area south of the Turner Salvage Garage, which continues to show elevated total petroleum hydrocarbon levels, although it is apparently underlain by an asphalt surface; an area between Buildings A and B not addressed during the removal action where elevated beryllium levels were detected in Department and EPA samples; recent oil contamination in the area of the compactor and baler, which were identified during the Department's annual inspection; an area near the west edge of the site that is devoid of vegetation; and, a former transformer-processing area that EPA sampling determined contains polychlorinated biphenyls.

Other nonhazardous solid wastes were removed and disposed off site, including asbestos-containing materials, empty drums and containers, and other miscellaneous materials. Three transformers also were removed and delivered to the city of Carrollton for reuse, as well as several compressed gas cylinders, which were to be reused or disposed of as appropriate. Numerous containers of asphalt sealer containing TCE were determined to be useable product and placed back into the facility's active inventory. Heritage Environmental removed containers of useable oil and grease that also were found.

Hazardous substances may remain on site. However, the Department completed an expanded site investigation on September 25, 1998 and recommended no further remedial action at Turner Salvage for the following

reasons: no evidence of contaminants affecting nearby drinking water wells exists; no evidence exists of contaminants migrating to nearby wetlands and fisheries; and site contamination is being addressed under a removal action. During an integrated Preliminary Assessment/Site Inspection, the Department collected shallow groundwater samples in the vicinity of the compactor and baler. These samples contained 181 parts per billion lead, which exceeds the State's water quality standard and EPA's drinking water action limit for lead of 15 parts per billion. However, the 1998 Expanded Site Investigation found no evidence of impact to the private drinking water wells in the vicinity.

In 2000, EPA approved Turner's removal compliance report, documenting the removal action conducted under an Administrative Order on Consent. EPA plans no further remedial or removal actions.

At the May 2013 inspection, the city of Carrollton had excavated a portion of the property's east side and installed a 30-inch sewer line and manholes. The city also had worked along the property's north portion. Soil stockpiles were located along the property's south portion and additional grading had been conducted. Following the inspection, a sinkhole approximately 6 feet wide by 6 feet deep had opened up in the property's north central portion due to a compromised active sewer line. The top of the sewer line had collapsed and, over time, the sinkhole was created as the soil above the sewer line break was carried away.

By July 2013, the city of Trenton had repaired the sewer line. The soil stockpiles located along the south portion were spread out across the property and regraded. No soil was removed from the site. The Fiscal Year 2018 annual inspection was completed on April 19, 2018. The inspection report noted nothing of significance.

General Geologic and Hydrologic Setting:

The site is located on alluvium of the Missouri River floodplain. The 50- to 100-foot thick alluvium consists of low-permeability, fine-grained clay and silt at the surface, grading with depth to coarser sand and gravel units with high permeability. Sand units are encountered typically within 20 feet below grade, and the gravel seams are present

nearer the alluvium/bedrock contact. Depth to the water table is about 15 feet. The alluvial aquifer, which is an important source of potable water for local inhabitants, is in direct hydraulic communication with the Missouri River.

Under normal flow conditions, groundwater beneath the site flows south to southeast toward the Missouri River, while surface water runoff enters the Standley Branch of Wakenda Creek, a stream located south of the facility. Wakenda Creek, a gaining stream, may also be in direct hydraulic communication with the Missouri River alluvial aquifer. The site is subject to occasional flooding from the creek and the river. Release of contaminants would readily affect the alluvial aquifer through direct infiltration.

The bedrock beneath the site is composed of Pennsylvanian-age limestones. Since the bedrock exhibits low permeability, release of contaminants would have minimal effect on the bedrock aquifer. Due to the mineralization of water within the bedrock, this aquifer is not used as a drinking water source. Release of dense non-aqueous phase liquids would be expected to impact the base of the alluvial aquifer, potentially migrating along the top of bedrock, which slopes toward the southeast.

Public Drinking Water Advisory:

The city of Carrollton and Carroll Co. PWSD #1 draw water from Missouri River alluvium, which is a valuable local and regional water source. Carrollton has four wells, the closest two of which are located approximately 1.3 miles southwest of the site. The city's other two wells are over two miles south-southwest of the site. Carroll Co. PWSD #1 uses two wells located over 3 miles southeast of the site. Groundwater flow in the alluvial aquifer trends to the south-southeast (toward the Missouri River) except when river levels are high, at which time the flow may direct north and northwest. Site-related contamination is unlikely to impact any of these wells.

Health Assessment:

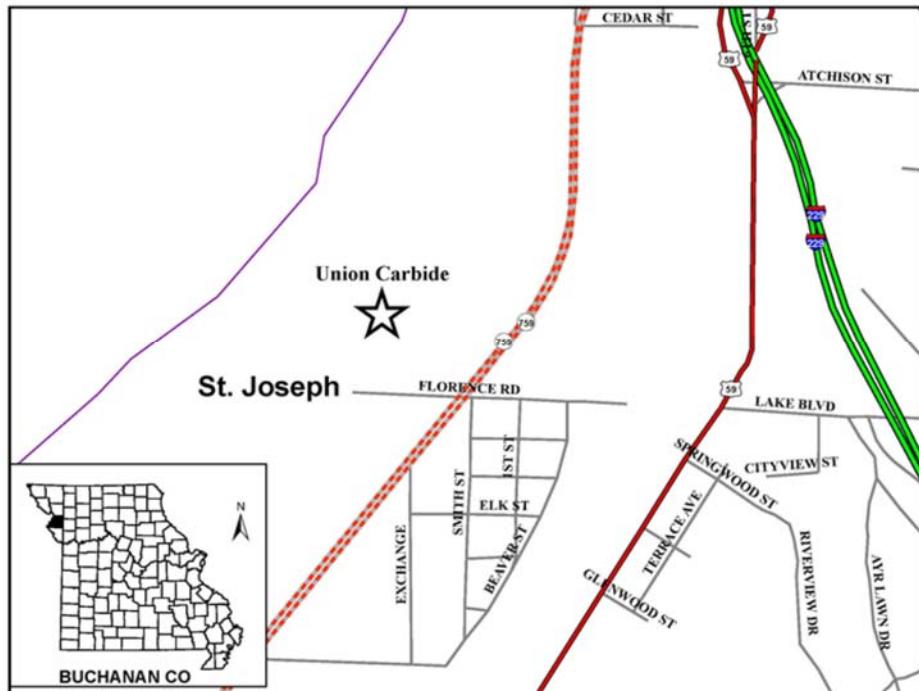
The primary contaminants of concern are: polychlorinated biphenyls, asbestos, toluene, ethylbenzene, xylene, 2-butanone, chromium, beryllium, lead, TCE, and xylene. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential

adverse health effects associated with these contaminants.

A determination was made that contaminants are not migrating to the municipal water supply. However, because of the uncontrolled nature of the wastes, this site may continue to present a public health threat. The site borders a stream, is near a wetland, and is in the Missouri River floodplain. Waste has been placed right up to the stream bank. Municipal wells are located within one mile. As a result of these conditions, surface water, groundwater, sediment, and soils are all potential exposure media and thus pose a potential health threat.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P.O. Box 570, Jefferson City, MO 65102, 573-751-6102.

Union Carbide



Site Name: Union Carbide

1975.

Classification: Class 4

Date of Registry Placement: December 12, 1996

Site Address: 317 W. Florence Road, St. Joseph, Buchanan County, Mo

Present Property Owner: Union Carbide Corporation

Lead Agency: Missouri Department of Natural Resources

Waste Type: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), 2,4,5-T

Quantity: Not determined

Site Description:

In 1956, Amchem Products began formulating herbicides and producing metal works on a 7.84- acre property in St. Joseph. Amchem formulated herbicides using the active ingredients 2,4-Dichlorophenoxyacetic acid (2,4-D) and 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T). These formulations sometimes produced the unwanted byproduct 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD). The facility ceased formulating these herbicides in

Soon thereafter, Union Carbide purchased the property and began formulating other herbicides. In 1986, Rhone-Poulenc bought the herbicide formulation facility. The company acquired only the property (2.5 acres) that contained the facility. Union Carbide retained the remaining 5.34 vacant acres of which only 3.80 acres remains on the Registry in 2018. In December 1997, Rhone-Poulenc sold the adjacent 2.5-acre property and facility to Nufarm Inc.

Contamination at the two properties dates from between 1956 and 1975, when herbicides containing dioxin were formulated by Amchem Products. Spills that occurred during Amchem Products loading and unloading operations contaminated the area near the rail siding at the Nufarm site. A lagoon that Amchem Products used for waste disposal from 1956 until 1975 has since been filled in, but remains a source of contamination on the property retained by Union Carbide.

The Union Carbide site is located north of the Nufarm site. Both properties are listed on the *Registry*. The Union Carbide site is capped, well-vegetated with grass, and enclosed by a 6-foot, chain-link fence with barbed wire at the top. The former lagoon area can only be

accessed by crossing through the Nufarm property. The Missouri River is about 50 yards from the western boundary. Railroad tracks lie between the site and the Missouri River. The site is located in a heavily industrialized area and access is controlled.

Environmental Problems and Areas of Concern:

The site is located in the flood plain of the Missouri River, which is about 50 yards away. Residential areas are located less than 0.5 mile southeast and less than one mile north.

Remedial Actions:

In 1975, Amchem Products drained and filled the lagoon. Water samples that Amchem Products collected from the lagoon prior to its closure revealed only traces of heavy metals and phenols. No further action was taken at that time.

A 1983 Resource Conservation Recovery Act inspection by the Department suggested that the lagoon be resampled. In 1986, EPA conducted sampling of the former lagoon. Individual soil grab samples revealed concentrations of dioxins (including TCDD) as high as 49 parts per billion at the surface. In 1988, Union Carbide contracted Pacific Environmental Services to conduct more extensive sampling. TCDD was detected at concentrations as high as 16 parts per billion (0-6 inches) and 76 parts per billion (6-20 inches) in composite soil samples.

In December 1997, Union Carbide petitioned the Department for a change in site classification. To evaluate the Union Carbide request, the Department required further investigation and remediation. In October 1998, Union Carbide conducted environmental sampling, including three groundwater monitoring well samples and two sediment samples. The samples were analyzed for 2,4-dichlorophenoxyacetic acid; 2,4,5-trichlorophenoxyacetic acid; Silvex (2,4,5-trichlorophenoxypropionic acid), and TCDD. None of the sample results exceeded regulatory limits for any of the contaminants of concern. Therefore, the Department reclassified the site as a Class 3 site.

In June 2001, the Department approved Union Carbide's cap work plan. The remedial construction was completed in July 2002, and

consisted of laying a drain pipe in the storm water ditch on the east side, placing a 1- to 2-feet thick compacted clay cap over the contaminated area, placing a 10-foot wide clay apron around the clay cap's perimeter, and placing a 6-inch topsoil layer over the cap to support a vegetative cover. Union Carbide also moved a fence to correspond with the southern property boundary. Union Carbide has committed to providing ongoing maintenance and inspections of the cap and vegetative cover. Survey markers were installed by Union Carbide to delineate the cap, cap apron, and buffer zones. Following the cap's construction, the Department reclassified the site to a Class 4 to reflect the reduced risk of exposure on site.

In fall 2002, the Department approved a Union Carbide request to reduce the area of the site listed on the *Registry* to the surveyed 3.80-acre area that includes the cap, cap apron, and buffer zones. The Department removed the 1.54-acre area to the north of the cap from the *Registry* after Union Carbide sampling confirmed that no hazardous waste is located on that portion of the property. No additional remedial actions have been conducted since the area was reduced in 2002. The Department completed its Fiscal Year 2018 Registry annual inspection on May 16, 2018. During the inspection, it was noted that the fenced area was mowed and the field was in excellent condition.

General Geologic and Hydrologic Setting:

The site is located on alluvium of the Missouri River floodplain. The 60- to 100-foot thick alluvium consists of low-permeability, fine-grained clay and silt at the surface, grading with depth to coarser sand and gravel units with high permeability. Sand units are encountered typically within 20 feet below grade, and the gravel seams are present nearer the alluvium/bedrock contact. Depth to the water table is 10 to 20 feet. The alluvial aquifer, which is an important source of water for local industry, is in direct hydraulic communication with the Missouri River.

Under normal flow conditions, groundwater beneath the site flows west toward the Missouri River. The site is subject to occasional flooding. High river stages could reverse the groundwater flow direction. High-yield wells in the vicinity may also affect the direction of groundwater flow. Release of

contaminants could affect the alluvial aquifer through direct infiltration.

The bedrock beneath the site is composed of Pennsylvanian-age limestones. Since the bedrock exhibits low permeability, release of contaminants would have minimal effect on the bedrock aquifer. Due to the mineralization of water within the bedrock, this aquifer is not used as a water source.

Public Drinking Water Advisory:

The city of St. Joseph obtains water from alluvial wells along the Missouri River and are unaffected by this site. No impacts to public water sources are expected.

Health Assessment:

The chemicals of concern at this site are TCDD and 2,4,5-T. Please refer to the Health Assessment Chemical Table in Appendix A for a description of the potential adverse health effects associated with these contaminants.

Currently, little opportunity for exposure exists, because the site is capped, vegetated, and fenced. Based on available information, no health risk is expected as long as the cap remains intact.

For more information regarding health-related issues, please contact the Missouri Department of Health and Senior Services, P. O. Box 570, Jefferson City, MO 65102, 573-751-6102.

APPENDIX A
HEALTH ASSESSMENT
CHEMICAL TABLE

HEALTH ASSESSMENT CHEMICAL TABLE

CHEMICAL	POSSIBLE HEALTH EFFECTS
Acetone	Irritant to eyes, skin, respiratory system, central nervous system (CNS) depressant. May cause dizziness, headache, nausea and vomiting.
Actinium	Occurs naturally through the decay of uranium minerals. See Uranium health effects
Alachlor (Lasso)	Probable human carcinogen; known animal carcinogen. May cause liver damage, skin irritation and irreversible eye damage.
Aldrin	Probable human carcinogen; animal teratogen. Targets CNS, liver, kidneys, and skin. May cause headache, dizziness, irritability, vomiting and uncontrolled muscle movements.
Aluminum	Replaces calcium in bone, implicated in Alzheimer's disease. May cause eye and upper respiratory irritation. May affect CNS.
Anthracene	Respiratory irritation and skin damage.
Antimony	Probable human carcinogen; animal carcinogen. May cause irritation of eyes and lungs, heart problems, stomach pain and ulcers, diarrhea, and vomiting.
Arsenic	Known human carcinogen. May cause skin irritation, digestive system disturbances, decreased production of red and white blood cells, and abnormal heart rhythm.
Atrazine	Possible human carcinogen. May cause heart, liver, kidney, peripheral nervous system damage, and decreased sperm concentration and mobility.
Barium	Targets respiratory system, CNS. May cause abdominal cramps, difficulty breathing, vomiting, and diarrhea.
Benzene	Known human carcinogen; animal carcinogen; suspected animal teratogen. May cause drowsiness, headaches, rapid heart rate, confusion, decrease in red blood cells, and affect the immune system.
Benzo(a)anthracene	Probable human carcinogen. Targets respiratory system, skin, bladder, and kidneys.
Benzo(a)pyrene	Probable human carcinogen. Targets respiratory system, skin, bladder, and kidneys. May cause reduced birth weight, neurobehavioral effects, and decreased fertility.
Benzo(b)fluoranthene	Probable human carcinogen. Targets skin, lungs, and urinary tract.
Benzo(ghi)perylene	Insufficient data.
Benzo(k)fluoranthene	Probable human carcinogen.
3,4-Benzofluoranthene	Insufficient data.
Benzoic acid	Targets eyes, skin, and mucous membranes.
Beryllium	Known human and animal carcinogen. Targets lungs, heart, liver, kidneys, spleen, skin, and eyes.
Beta-hexachlorocyclohexane	Possible human carcinogen. May cause CNS depression.
Bis (2-ethylhexyl) phthalate	Known animal carcinogen; probable human carcinogen. May cause respiratory and gastrointestinal illness.
Bromodichloromethane	Suspected animal carcinogen; possible human carcinogen.
2-Butanone	Targets the lungs, nose, throat, eyes, skin, and CNS.
Butyl benzyl phthalate	Possible human carcinogen.
Cadmium	Probable human carcinogen, animal teratogen. Attacks lungs, kidneys, blood, and irritates the stomach.. May cause aching pains in back and limbs, chills, and generalized weakness.
Carbon Tetrachloride	Known animal carcinogen; probable human carcinogen. Targets liver, kidneys, and CNS.
Chlordane	Known human and animal carcinogen. Targets CNS, digestive system, eyes, lungs, liver, kidneys and skin. May cause headache, irritability, vision problems,

	weakness, jaundice, seizures, and coma.
Chlorobenzene	CNS depressant; attacks lungs, liver and kidneys. May cause headache, nausea, labored breathing and sleepiness.
Chlorodibromomethane	Possible human carcinogen. May cause CNS functional disturbances.
Chloroform	Known human carcinogen. Hepatic and renal damage and CNS depressant. May cause dizziness, fatigue, headache, and skin sores.
Chromium	Chromium (VI) is a known human carcinogen respiratory system damage; liver and kidney effects; toxic effects vary with valence state. May cause irritation to the skin, digestive system, and damage to the male reproductive system. Inadequate evidence in humans for carcinogenicity of metallic chromium and chromium (III) compounds.
Chrysene	Known animal carcinogen; probable human carcinogen.
Cobalt	May cause asthma, pneumonia, wheezing, and contact dermatitis
Cyanide	CNS depressionMay cause breathing difficulties, , headaches, chest pain, vomiting, enlargement of the thyroid gland, Digestive system disorders andcardiovascular dmage.
2,4-D	Weakness, stupor, hyporeflexia, muscle twitching, convulsions, and dermatitis. Targets the liver, kidneys, and CNS. Insufficient data to determine human carcinogenicity.
DDT.DDD.DDE	Probable human and animal carcinogen. Targets nervous system, liver, kidneys, and skin.
Delta-hexachlorocyclohexane	May cause lung irritation, headache, and convulsions.
Dibenz(a,h)anthracene	Probable human carcinogen.
1,2-Dichlorobenzene	Targets liver, kidneys, skin, eyes, and respiratory system.
1,3-Dichlorobenzene	May cause irritation to eyes, nose and throat, stomach pain, nausea, vomiting, and diarrhea. May damage liver and kidney.
1,4-Dichlorobenzene	Possible human carcinogen; known animal carcinogen. Targets liver, kidneys, eyes, skin, and respiratory system.
3,3-Dichlorobenzidine	Known animal carcinogen; probable human carcinogen. May cause dermatitis, and respiratory infection.
1,1-Dichloroethane	Possible human carcinogen. CNS depressant; skin irritant; liver and kidney damage.
1,2-Dichloroethane	Probable human carcinogen; suspected animal teratogen. CNS depressant; digestive system disorders; respiratory and circulatory system damage.
1,2-Dichloroethene	CNS and respiratory depressant. May cause kidney, liver, and lung damage, nausea, drowsiness; skin and eye irritant.
2,4-Dichlorophenol	May cause mouth, throat, and stomach irritation; abdominal pain, pallor, sweating, weakness, headache, and dizziness.
Dieldrin	Probable human carcinogen, animal teratogen. Attacks CNS, liver, kidneys, &skin.
Diethyl phthalate	Respiratory, mucous membrane, and dermal irritant.
2,4-Dimethylphenol	Possible human carcinogen. May cause irritation of tissue and mucous membrane.
Di-n-butyl phthalate	Respiratory, mucous membrane, and dermal irritant.
Di-n-octyl phthalate	Suspected animal teratogen. May cause mucous membrane irritation.
1,3-DNB (explosive)	Probable human carcinogen. Targets CNS.
Endosulfan	CNS damage. May cause agitation, tremors and convulsions.
Endrin	Targets CNS and liver. May cause headaches, dizziness, confusions, nausea, vomiting, and convulsions.
Ethylbenzene	Renal and hepatic disorders. Chronic respiratory and dermal disease. CNS depressant. May cause throat, eye, and mucous membrane irritation.
Ethylene	Loss of coordination, unconsciousness, convulsions and paralysis. Targets eyes, skin, respiratory system, and CNS.

Ethylene dibromide	Probable human and animal carcinogen. Targets eyes, skin, respiratory system, liver, kidneys, and reproductive system.
Fluoranthene	Attacks urinary and hepatic systems.
Heptachlor	Probable animal carcinogen, probable human carcinogen. Targets CNS and liver.
Heptachlor epoxide	Probable human carcinogen. Targets CNS and liver.
Hexachlorobenzene	Possible human carcinogen; probable animal carcinogen. May cause weight loss, enlargement of the thyroid, skin sores, and discoloration. Liver, reproductive system and CNS effects.
Hexachlorophene	May cause nausea, vomiting, irritability, dehydration, and hypotension.
Indeno(1,2,3-cd)Pyrene	Probable human carcinogen. No known short term health effects at this time.
Isophorone	Possible human carcinogen. Central nervous system depressant; dermal, eye, nose, and throat irritant. May cause nausea, headache, and dizziness.
Lead	Probable human carcinogen. Digestive system discomfort; muscular system weakness; CNS damage; affects blood and liver. No safe blood lead level in children has been identified. In children, lead exposure is associated with hyperactivity, attention and conduct problems, and impairment in cognition.
Lindane (Gamma-hexachlorocyclohexane)	Known animal carcinogen; Probable human carcinogen. Targets eyes, skin, respiratory system, blood, liver, kidneys, and CNS. May cause muscle and kidney necrosis, digestive tract inflammation, and hemorrhage.
Manganese	Known animal teratogen. Targets respiratory system, CNS, blood, lungs, and kidneys.
Mercury	Targets CNS, kidneys, respiratory tract, skin, and gingival tissue. May cause changes in vision and hearing, memory loss and tremors, digestive distress, increase in blood pressure or heart rate, skin rashes, and eye irritation.
Methoxychlor	CNS depressant. May cause nausea and headache.
Methylene Chloride	Probable human carcinogen and known animal carcinogen. May cause cardiovascular irregularities; CNS depressant.
Naphthalene	Known animal carcinogen; possible human carcinogen. May cause destruction of red blood cells, fatigue, loss of appetite, pale or yellow skin, digestive distress, and blood in urine.
Nickel	Known animal carcinogen, suspected animal teratogen; possible human carcinogen. CNS depressant; respiratory system damage; liver and kidney effects.
P-chloro-m-cresol	May cause mouth, throat, and throat irritation; pallor, sweating, weakness, headache and tinnitus. Skin exposure may cause contact exzema and pentachpain followed by numbness
Pentachlorophenol	Probable human carcinogen; probable animal carcinogen. Irritation to skin, eyes, respiratory system; possible damage to liver and kidney. May cause increase in body temperature resulting in injury to various organs and tissues.
Phenanthrene	Suspected animal carcinogen; possible human carcinogen. Targets skin, bladder, kidneys, and respiratory system.
Phenol	Affects the digestive system, CNS, liver, and kidneys. May cause skin and eye damage.
Polychlorinated biphenyls	Animal carcinogen; probable human carcinogen; hepatotoxin and embryotoxin. May cause skin irritation (chloracne) and liver damage.
Polycyclic Aromatic Hydrocarbons (PAHs)	Certain PAHs are positive animal carcinogens and positive human carcinogens.
Pyrene	Known animal carcinogen; possible human carcinogen. Targets skin, bladder, kidneys, and respiratory system.
Radium	*Known human carcinogen. Series effects include lymphoma, bone cancer, and diseases that affect the formation of blood, such as leukemia and aplastic anemia. External exposure to radium's gamma radiation increases the risk of cancer to varying degrees in all tissues and organs.
RDX (explosive) 1,3,5-trinitro-1,3,5 -triazine	Probable human carcinogen. CNS effects, such as seizures. May cause nausea, vomiting, eye and skin irritation, headache, irritability, fatigue, and insomnia.
Selenium	Targets CNS, liver, heart, and respiratory tract.

Sodium	Increases blood pressure. Vapors and fumes may cause eye, skin and respiratory tract irritation.
Styrene	Possible human carcinogen; known animal carcinogen. May cause eye, skin, and respiratory system irritation. CNS depressant.
2,4,5- TP (Silvex)	May cause contact dermatitis, fatigue, weakness, anorexia, dizziness, and abdominal pain.
2,4,5- Trichlorophenol	May cause eye, nose, pharynx, and lung irritation; skin redness and edema.
2,4,5-T (Trichlorophenoxyacetic Acid)	Weakness, malaise, loss of appetite, and heart failure.
2,3,7,8-Tetrachlorodibenzo-para-dioxin (2,3,7,8-TCDD, or Dioxin)	Known human and animal carcinogen. Chloracne; thymic atrophy; liver damage. Suspected to cause soft tissue sarcoma, Non-Hodgkin's Lymphoma, porphyria cutanea tarda, and Hodgkin's disease.
1,1,2,2-Tetrachloroethane	Possible human and animal carcinogen. Targets CNS, blood, liver, and kidneys. May cause drowsiness, nausea, vomiting, shallow breathing, liver enlargement, and possibly unconsciousness.
Tetrachloroethylene (PCE)	Probable human carcinogen and known animal carcinogen. Hepatotoxin; renal injury and CNS depressant. May cause dizziness, incoordination, and changes in mood, memory, reaction time, and vision.
Tetraethyl lead	May cause insomnia, psychosis, mania, liver damage, elevated blood lead levels, pallor, and disorientation.
Thimet (Phorate)	Targets CNS, eyes, and skin.
Thorium	Known human and animal carcinogen. Series effects include lung, pancreas, & bone cancer.
Toluene	CNS depressant; liver and kidney damage. May cause confusion, tiredness, memory loss, loss of appetite, and hearing and color vision loss.
Toxaphene	Probable human carcinogen; known animal carcinogen. Targets the skin, liver, kidneys, and CNS.
1,1,1-Trichloroethane	Known animal carcinogen; CNS depressant, targets the liver and kidneys. May cause dizziness, loss of coordination, and decreased blood pressure.
1,1,,2-Trichloroethane	Possible human carcinogen. CNS depressant and skin irritant.
Trichloroethylene (TCE)	Known human and animal carcinogen. CNS depressant; renal and hepatic damage. Suspected increased risk of congenital heart defects in children of older women of child bearing age. May cause headaches, dizziness, sleepiness, coma, and autoimmune diseases.
Trifluralin (Treflan)	Possible human carcinogen. May cause respiratory tract, eye, and skin irritation.
Uranium	Known human and animal carcinogen. Series effects may include kidney damage, lung cancer, osteosarcoma, and lymphoma. May cause damage to dental tissue causing teeth to break, cataracts, necrosis of bone, and growth retardation in children.
Vinyl chloride	Known human and animal carcinogen; CNS depressant. May cause dizziness, unconsciousness, and nerve damage.
Xylenes	CNS depressant; liver and kidney damage. May cause headaches, loss of muscle coordination, confusion, and changes in one's balance.
Zinc	Some forms may be carcinogenic and/or affect the peripheral nervous system. All may cause gastrointestinal distress.
Zirconium	May cause eye irritation, blurred vision, burning of nose and throat, vomiting, and liver damage.

* A secondary associated risk is due to the decay product radon (radon-222 and radon-220), and its short-lived daughters. The primary hazard associated with radon arises from the inhalation of its short-lived decay products, which are charged ions that readily attach to dust particles. These particles can be inhaled into the lungs and deposited on the mucous lining of the respiratory tract, potentially leading to lung cancer;

APPENDIX B

GLOSSARY OF

HEALTH TERMS

GLOSSARY OF HEALTH TERMS

acnegenic

Producing or increasing the severity of acne.

aplastic anemia

A rare but extremely serious disorder that results from the unexplained failure of the bone marrow to produce blood cells.

carcinogenic or carcinogen

Capable of causing cancer. A suspected carcinogen is a substance that may cause cancer in humans or animals but for which the evidence is not conclusive.

central nervous system (CNS)

Brain and spinal cord.

chloracne

A rare acne-like skin condition caused by exposure to herbicides or chlorinated chemicals, including the dioxins. It develops a few months after swallowing, inhaling or touching the responsible agent.

cholinesterase

An enzyme produced in the liver that is required for normal nervous function.

conjunctiva

The membrane that lines the eyelids and covers the white part, or sclera, of the eyeball. When an individual has conjunctivitis, the reflection of the inflamed conjunctiva makes the white of the eye appear red.

cutaneous

Of, relating to, or affecting the skin.

embryotoxicity and fetotoxicity

Any toxic effect on the embryo (embryotoxicity) or fetus (fetotoxicity) as a result of prenatal exposure to a substance that crosses the placental barrier. The distinguishing feature between the two terms is the stage of development during which the insult occurs. Toxic effects can include malformations and variations, altered growth, and in utero death.

fetotoxicity

See "embryotoxicity."

genotoxicity

Damaging to DNA or pertaining to agents (radiation or chemical substances) known to damage DNA, thereby causing mutations or cancer.

gingival tissue

Gum tissue.

hepatic

Of, relating to, affecting, or associated with the liver.

Hodgkin's disease

One of the two basic types of lymphoma, Hodgkin's is a cancer that develops in the lymphatic system, the part of the body's circulatory system that helps fight disease and infection.

hyperpigmentation

An increase in the natural color of the skin.

hyporeflexia

Underactivity of bodily reflexes.

immunity

The ability of an organism to resist disease or toxins by natural or artificial means.

immunogenic

Producing immunity or evoking an immune response. An immunological effect is the production of a functional change in the immune response. Immunologic toxicity causes the occurrence of adverse effects on the immune system and may result from exposure to environmental agents such as chemicals.

keratosis

A disease of the skin marked by growth of scaly tissue.

lymphoma

Any of various malignant tumors that arise in the lymph nodes or in other lymphoid tissue.

mesothelioma

A malignant tumor of the mesothelium. The mesothelium is the thin lining on the surface of the body cavities and the organs that are contained within them.

morbidity

The rate of incidence of a disease.

mutagen

A substance that causes mutations. A mutation is a change in the DNA sequence contained in a cell. Mutations can lead to birth defects, miscarriages, or cancer.

mutagenic

Causing alteration in the DNA (genes or chromosomes) of an organism.

natality

The ratio of total live births to total population in a specified area over a specified period of time; birthrate.

narcosis

A condition of deep stupor or unconsciousness produced by a drug or other chemical substance.

non-Hodgkins lymphoma

A group of malignancies, with differing patterns of behavior and responses to treatment, in which cancer (malignant) cells are found in the lymph system.

osteosarcoma

A sarcoma derived from bone or containing bone tissue; also called osteogenic sarcoma.

peripheral neuritis

General classification of disorders involving damage or destruction of nerves, not including the nerves of the brain or spinal cord (CNS).

pneumonitis

A disease characterized by inflammation of the lungs.

porphyria cutanea tarda

The most common form of porphyria, causes blistering of skin exposed to sunlight. Porphyrias are a group of disorders caused by deficiencies of enzymes involved in the synthesis of heme, a chemical compound that carries oxygen and makes blood red.

pulmonary edema

A condition in which fluid accumulates in the lungs, usually because the heart's left ventricle does not pump adequately.

renal

Relating to, involving, affecting, or located in the region of the kidneys.

sarcoma

Cancerous growth of the soft tissues.

teratogenic

Capable of causing abnormal development of the embryo and congenital malformations.

teratogenicity

The ability or tendency to produce anomalies of formation.

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